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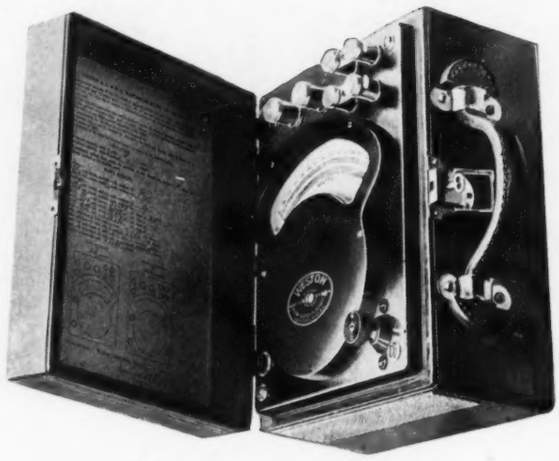

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Southern Water Power and Education

BY HIS gift of $40,000,000 to educational and other institutions in North and South Carolina James B. Duke has given a distinction to the Southern Power Company not possessed by the other hydro-electric properties of this country. Having harnessed the water powers of the Carolinas for the good of their inhabitants and of their industries, Mr. Duke now bequeaths the income derived from his electrical enterprises for the education of preachers, teachers, lawyers and engineers in those states. Thus the industry furnishes another example of a public-spirited man whose purview extends far beyond the power business into the realms of the humanities and of sincere social service.

Nor are those on whom the successful operation of the properties depend forgotten, for both W. S. Lee and C. I. Burkholder are included among the trustees who will administer the gift. While the Southern Power Company will thus keep its corporate entity for years to come, we trust that the breadth of vision shown by Mr. Duke will continue to be shown by the trustees in the operation of the property in close co-operation with other Southern power companies for the upbuilding and enrichment of the Old South.

Economy and Reliability in Station Design

STANDARDS of service in the light and power industry have become so high that designers of power plants have come to consider economy and reliability as equally important. But of the two reliability is the more difficult to evaluate, for, assuming reliable and normal operation, it is comparatively easy to determine the cost of power in cents or in B.t.u. per unit of output. It is also easy to compute the cost of a station designed to operate with high pressure, large units, reheating and many other developments that result in decreased fixed and operating charges, if it be assumed that such a station is equally reliable with a more conservatively designed installation.

The goals of high economy and low costs are worth striving for, and it is very unfortunate that the reliability factor in the economic equation is indeterminate for nearly every plant. Yet all stations are built to operate as a first consideration and all other elements are secondary. The actual money value to place on the relative reliability of two designs of equipment is always vague and always debatable. Many engineers say: "You either get a good one or you don't—it's a matter of luck. Of two turbines made by the same company from the same plans, one may be counted upon to operate splendidly and the other counted upon to give trouble." In a large degree this condition holds true of power stations, and the big problem of manufacturers, designers and operators is to reduce reliability to a known value in dollars and cents. Once this rather idealistic condition is reached, the economic problem of power-station design is largely solved.

All credit is due the courageous designers of power stations embodying new ideas and new machines. It is only by means of data obtained in practice that reliability will ever be evaluated.

Notable Tribute to a Private Citizen

AS ONE of its outstanding men, the electrical industry is naturally interested in Owen D. Young. His career within the industry is an open book; his accomplishments in other directions, while not quite so well known, are nevertheless appreciated. When Mr. Young, after serving on both of President Wilson's industrial conferences, was chosen permanent chairman of the committee appointed by Secretary Hoover to investigate and devise remedies for non-employment, every one in the electrical industry expected him to acquit himself with honor, and no one was disappointed. When later he was chosen as a member of the committee of experts to assist the Reparations Commission, the whole world hoped that a solution would be found. With O. D. Young on the job the electrical industry felt "within its bones" that success, if it were at all possible, would follow, and again these expectations were not disappointed.

Last week the business men of New York tendered Mr. Young a testimonial dinner in recognition of his work abroad for the cause of peace and greater amity among the nations of the world. No more influential group of men ever gathered together in one place in the metropolis of the Western Hemisphere, and statesmen of Europe vied with those of our own country in heaping plaudits on a private citizen of the United States. The honor was richly deserved, for the work of the committee of experts, and particularly of the man who afterward became the ad interim Agent General of Reparation Payments, was work of the fundamental and far-reaching kind on which national and international history is built.

Two days after Mr. Young became the modest and almost unwilling recipient of this extraordinary tribute another American who had wrought long and well for his country and mankind closed his career with the supplication on his lips that American institutions might become still better. Samuel Gompers and Owen Young have wrought in different spheres, but their aspirations have had much in common. The farmer's boy and the immigrant youth have alike displayed the gift of leadership and the spirit of progress. It is not fantastic to couple their names, for in such leadership of capital and of labor lies the hope that a century of industrial strife may be followed by long years of industrial peace and co-operation.

Electricity in the Construction Industry

A RECENT survey throughout a large part of the contracting and construction industry shows an increasing desire on the part of contractors to use electricity in their construction work. A serious study of the results of this survey shows that this field presents possibilities of substantial revenue to electric light and power companies which keep track of proposed building operations within practicable reach of their lines.

The change from donkey engines and other types of steam or gas-engine equipment, the electrifying of shovels and other construction machinery, is coming as a natural result of the greater extension of electric power networks. It used to be that most construction work created the edifice which later attracted electric service. But with the increase of the network of electric lines there is increasing probability that any piece of construction work will find itself near enough electric service to avail itself of the opportunity. As the network becomes more and more widespread to an approach of universality, the construction industry will find itself able to depend entirely on electric power for its operations.

To convert an entire industry is not just one day's work. Some contractors have the foresight and practical sense to use electricity when it can be made available, and the survey mentioned shows that some of them are taking the initiative. But just as it took time to electrify manufacturing industries, so will it take some time and active commercial work to convince the average foreman or his practical boss that the donkey engine has met its master wherever its master's tentacles may reach.

Another Raid on Second-Class Mail

IT IS a dull session of Congress when nobody advances a theory or presents a bill to change postal rates on second-class matter. The public voices no dissatisfaction with the trend of development in magazine and newspaper publishing. It is obvious and accepted as a fact that the broad distribution of news and information of an educational character though the popular and business publications has been the greatest single influence in the upbuilding of American industries and American standards of living. The spectacular growth of the great magazines and newspapers, which present the work of the most advanced thinkers as well as the best writers and artists of the day and carry the message of the seller into every household in the land, has been possible only because the people crave the opportunities and benefits which this great service of the modern press brings into their daily lives. But the fact remains that the Post Office Department shows a heavy deficit year after year and nobody knows why, and so the theorists present their plans for increasing revenue, usually by proposing to levy a special tax upon the readers of these periodicals and those who advertise in them.

Now comes Postmaster-General New with a recommendation that, were it instituted, would probably drive newspapers and magazines out of the mails into other channels of distribution, defeating the very purpose in mind by cutting down the postal revenues enormously. The suggestion provides for increasing the postal rates to a point varying from 100 to 900 per cent above prewar cost. It also purposes to discriminate between the advertising and the editorial pages of a publication, imposing heavier charges on the former. And this opens up again the old discussion of whether or not advertisements are of their very nature both news and education. Who that has read the announcements and the information contained in the advertising pages of any modern magazine can say they are not both? Mr. New also proposes to raise the rate on post cards to 1½ cents. Will this produce more money or cause the public to write fewer cards? Who knows?

The pity of it is that the country must go on year after year with no accurate knowledge of the true economics of our postal enterprise. There is neither good sense nor justice in meeting a deficit with a raid. The question is, what readjustment of the postal rates will serve the people best? Or do they prefer to pay their money in taxes rather than for stamps?

Pyro-Electric Theory of Insulation Under Attack

ALL dielectrics have some conductivity. Temperature increases this conductivity, especially in composite fibrous types of insulation. Dielectric absorption, which is high in these materials, is also increased by temperature, and the rates at which both conductivity and absorption increase are quite high. When such insulation is subjected to alternating stress losses occur, due principally to the absorption, but also to the conductivity. These losses cause heating, and if the heat is not carried away rapidly, there may result inequalities of temperature with consequent local heating and increased losses. It is probable that inequalities of this character explain many of the irregularities to be found in the study of the properties of insulation. Local heating has long been known in cables and recognized as a forerunner to breakdown.

The foregoing facts were brought together into a theory some two years ago by K. W. Wagner to account for dielectric failure by rupture. The theory in substance is that a local thread of the dielectric of relatively high conductivity leads to local heating, which in its turn leads to further increase of conductivity, with the final result that there is unstable equilibrium between heat generation and dissipation and so burning and breakdown. The position therefore is that breakdown occurs solely as the result of heating due to the passage of current. The theory is supported by experiments and also by calculations, under certain simple assumptions, leading to results in accord with the theory. The simplicity of the theory has made a strong appeal in this country, particularly as it was in great measure supported by similar experiments by Steinmetz and Hayden. However, two of Wagner's fellow-countrymen, Rogowski and Karman, have leveled serious criticism at Wagner's analysis. By extending his own assumptions they have shown that in certain simple cases it leads to results very widely at variance with observation and experiment. An essential feature of the Wagner treatment is the assumption of a single method of dissipation of the heat generated. Rogowski in theoretical analysis considers all methods of heat dissipation and reaches the conclusion that the resulting calculations of breakdown voltages are absurdly high and that the temperature rises sufficient for cumulative

heating are absurdly low. The Wagner conclusion that the breakdown voltage is directly proportional to the thickness of the dielectric was questioned by Doctor Steinmetz in the discussion of the original paper before the A. I. E. E., and this is now questioned also by Rogowski and Karman. Thus it appears certain that the pyro-electric theory cannot explain the breakdown of thin dielectrics, low-temperature failures and failures under short-time applications. On the other hand, temperature rise undoubtedly plays a part in the case of thick plates, high temperatures and long applications.

It must be remembered, however, that heating may arise in other ways than through current conduction. We know very little about the causes of dielectric losses. Further, there is no difficulty in accepting the idea of disruptive breakdown, for it occurs in gases, and in this case the voltage for such breakdown may be lowered by temperature. It is probable, therefore, that we have in the pyro-electric theory only one method in which breakdown may occur. Considered in this light, it adds something to our knowledge, but it is by no means a complete answer to the problem of the general nature of electric breakdown. It emphasizes once more the extreme complexity of dielectric phenomena and our scanty definite knowledge of them.

Distinguishing Between Illumination and Brightness

FOR years the chief factor in the consideration of lighting has been the foot-candle, but much misunderstanding has resulted. "Intensity" of illumination (measured in foot-candles) is the cause and "brightness" (measured in foot-candles or other terms) is the effect. A statement that 10 or 20 foot-candles is a satisfactory intensity of illumination is incomplete. If the illuminated surface has a reflection factor of 80 per cent (a good "white" paint), it will have a certain definite brightness when the intensity of illumination is of a certain value. Another surface having a reflection factor of 20 per cent (a medium "gray" paint) will be only one-fourth as bright under the same illumination. The brightness of a diffusely reflecting surface is found by multiplying the foot-candles by the reflection factor and then multiplying this product by a constant which differs for the various units of brightness in use. For obtaining foot-lamberts this constant is unity.

Everywhere in the practice of lighting there is evidence of a lack of appreciation of the importance of brightness. If certain details are to be distinguished against a background of low reflection factor, a correspondingly higher intensity of illumination is necessary than when the background is of a higher reflection factor, assuming other conditions to be equal. For example, if 20 foot-candles are considered satisfactory for reading black print on a white background or for sewing with black thread on a white cloth, at least 80 foot-candles are necessary if the background is a medium gray. If the cloth is a dark blue, about 200 foot-candles would be necessary for comparable vision.

The importance of brightness is primary because it is the final result of illumination. But, of course, intensity of illumination reflects this importance because there cannot be brightness without it. In considering one lighting problem in relation to another it is well to compare brightness first.

Good Housekeeping Means Good Service

A REGULAR maintenance schedule for the equipment used by a light and power company pays dividends. Experience with many devices over a period of years proves the necessity for adequate maintenance if reliable service is to be rendered and the equipment is expected to operate efficiently. The washing of insulators, the filtering of oil in transformers and breakers, the testing of meters and relays are common practices, and many other inspection and maintenance operations have been proved effective and economical.

Duplicate equipment is found necessary in many instances if proper inspection is to be had. Even though this necessitates an extra investment in breakers, transformers, generators and lines, the cost has been found to be an insurance reserve and much less than might become necessary if no maintenance were had. In many cases the inspection of breaker contacts, the testing and filtering of oil, the testing of cables and the checking of relays have disclosed dangerous situations before they developed into disasters to equipment and to service. Keeping equipment tuned has become accepted practice by light and power companies.

But to derive the full benefit of a maintenance schedule customers must also see that their equipment is kept in tune, and with the growth in the number of customers supplied at high tension it is important to all interests that these customers understand the value of maintenance and be encouraged to adopt good practices and even to purchase duplicate equipment. The demands for higher service standards are most easily and most cheaply met if both producers and consumers adopt good housekeeping methods.

Home-Lighting Essay Prizes Now for Electrical Men

THE plan announced by the Lighting Educational Committee for a special essay contest among the employees of light and power companies and electrical manufacturers and jobbers will bring a most appropriate conclusion to the home-lighting campaign which has so occupied the attention of the industry of late. A new set of national and perhaps also regional prizes will be offered, and the left-over stock of lighting primers will be utilized to teach the same lesson to electrical men and women that has had such wide dissemination among the school children. It is an excellent idea, for all employees of electrical companies are by no means well posted on the rudiments of electrical knowledge that they should be constantly assisting to interpret to the public.

Meanwhile the children's contest continues to roll up good evidence of gratifying results. In Detroit, for example, 36,000 essays were turned in from 52,000 children who accepted primers. In Omaha 5,100 essays were submitted out of a distribution to 17,000 children. And so it goes. Packages of local prize-winning essays are now pouring in at the committee's headquarters. More than eight hundred parcels arrived on one day this week. More than two million primers were distributed. Unquestionably much good will come out of all this. Now, if the same seed can be planted among the men and women of the industry, the yield should be immeasurably greater, for the example and influence of electrical men can be made far-reaching.

Louis Allis

A manufacturer of electric motors who has become a leader among the "independent" group because of his success in developing his business, his zeal as a co-operator and his broad idealism in promoting the human relationships of industry

THERE is nothing more interesting or romantic in the world of business than to see a small shop grow into a large manufacturing establishment of national reputation. Such progress and recognition come only through the leadership of some man whose ideals of quality and of service are large. There is no better example of this in the electrical industry than the case of Louis Allis, president of the Louis Allis Company of Milwaukee, and the motor manufacturing enterprise which he has built up from an insignificant beginning into a position well to the fore among the "independent" motor manufacturers.

Louis Allis inherited a great tradition from his father, Edward P. Allis, one of the foremost manufacturers of the electrical industry a generation ago, whose company was merged with another to form the Allis-Chalmers Company. It has been the son's ambition to build anew under the Allis name as an expression of his father's philosophy—which is also his own—that human relations can be made the enduring strength of a business if personal friendship is developed between the employer and the worker, between the manufacturer and those to whom he sells and between competitors in any field.

Around this ideal he has organized a motor manufactory that has been one of the most successful in the industry. It is built upon the practical foundation of notable engineering proficiency, which has been directed toward rendering special service both in the design and the application of motors to makers of motor-driven machinery, who are beset by problems of application engineering that call for closer study and co-operation than are ordinarily embraced in design alone.

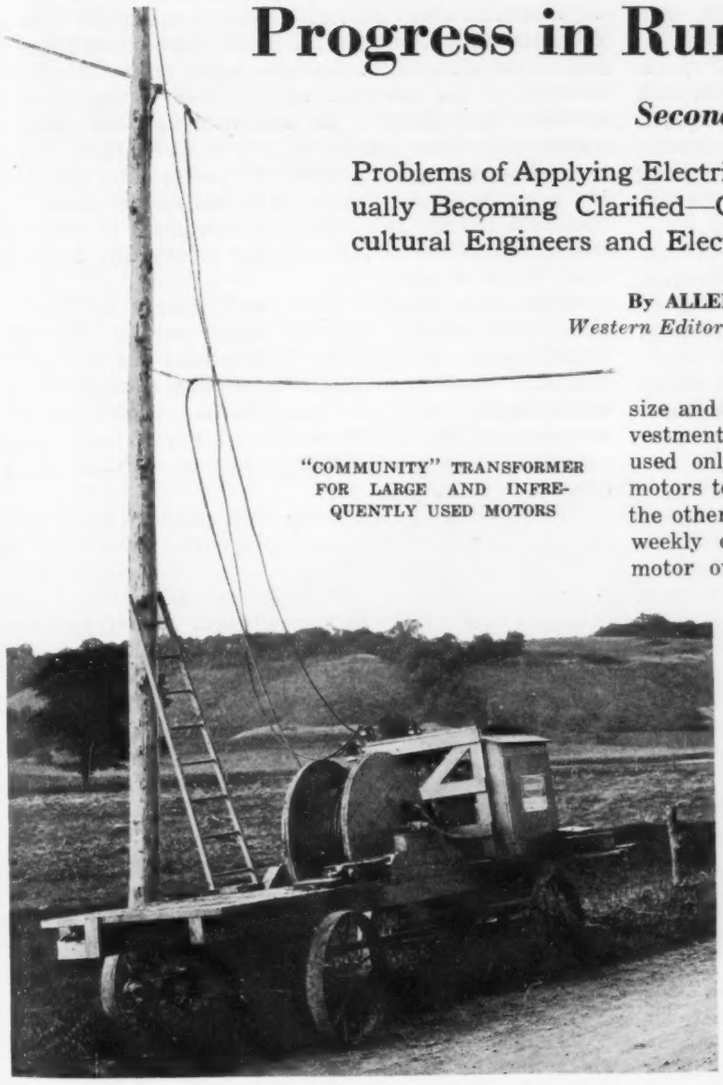
Louis Allis was born in Milwaukee in 1866 and was graduated as a civil engineer from Pennsylvania Military College in 1888. He first went to work for his father in the Edward P. Allis Company plant, becoming finally director of purchasing. Soon after the consolidation into the Allis-Chalmers Company he retired from active business because of ill health. Later he became president of the Mechanical Appliance Company of Milwaukee and once more interested in the manufacture of electric motors. This company, now the Louis Allis Company, has prospered under his leadership, steadily increasing in production and in prominence.

Progress in Rural Service Study

Second Article

Problems of Applying Electricity to Agricultural Work Gradually Becoming Clarified—Co-operative Solution by Agricultural Engineers and Electrical Manufacturers Necessary

By ALLEN M. PERRY
Western Editor ELECTRICAL WORLD



"COMMUNITY" TRANSFORMER FOR LARGE AND INFREQUENTLY USED MOTORS

THE attempt to apply motors to farm operation on the Red Wing line in Minnesota has developed a number of problems which must be solved if the use of electricity in agriculture is to become economical and feasible for the farmer. For example, a large number of power machines are slow-speed affairs, while the most efficient types of motors are high-speed. The belting of a motor directly to a farm machine presents a very difficult problem in most cases. Even where the farm machine is driven at a relatively high speed, it is frequently inconvenient to use very large pulleys on the farm equipment. Therefore the farmers are inclined to use small pulleys on the motor to secure the proper speed on the driven machine.

So far the study indicates the desirability of three classes of motor service for the farm — individual motors, small utility motors and large utility motors. In addition, it has been considered desirable to have one very large utility motor for community service.

Individual motors would be used on operations that are repeated daily. The time required to set up a separate motor, tighten the belt and so forth for such operations would offset the cost of an individual motor. In most cases the individual motor would be of small size and therefore would not represent a very large investment. Even some types of equipment which are used only weekly might be equipped with individual motors to advantage if they require a small motor. On the other hand, some operations which may be repeated weekly or bi-weekly can be performed by the same motor owing to the diversity in demand. One such operation is churning; the motor that runs the churn may also be used to run a grindstone, fanning mill, sausage grinder, etc. Such operations would require only a small utility motor of perhaps ½ hp. However, if churning is repeated frequently enough, the churn would probably be better equipped with an individual motor.

On the average Minnesota farm which carries considerable stock several operations are involved requiring a large utility motor of perhaps 5 hp. For example, feed grinding may occur on many farms as often as two or three times a week, in which case an individual motor for this operation might be used. However, an individual motor of this size represents a relatively large investment and may be used for other purposes such as elevating grain, shelling corn, sawing wood and perhaps cutting ensilage and husking corn. Where the farm is equipped with a windmill the same motor could be used ordinarily for pumping water. In such cases the motor would have a rating of 2 hp. to 5 hp.

Some operations on the farm require a large amount of power for only a short time. Examples of these are threshing, cutting ensilage, sawing lumber, tillage operations and operating large husking and shredding machines. Since the size of motors (15 hp. to 20 hp.) required for these operations represents a large investment and creates a large peak on the customer's transformer, the Minnesota committee considers it advisable to have a large community motor for such purposes. It can be mounted on a portable platform with its individual transformer and switching apparatus so that it may be connected with the primary line and transported from one farm to another. However, it is questionable whether such a motor can be shared among more than three or four farmers.

A problem in the application of any one of these three types of motors is to obtain the proper equipment speed. Individual motor drives can be built into the machine to give the proper speeds. A utility motor, however, must operate machines that have widely different speeds. Small pulleys are not desirable on the motors in order to

get the proper speeds on the farm machines, because their use entails tight belts, which cause trouble with hot bearings, decreased life of the belt, etc.

Farm operations may be classified under three speeds —low, high and variable—although the speed with each type of machine varies considerably. For example, under low-speed operation fall: Pumping, 200 r.p.m.; concrete mixing, 300 r.p.m.; grindstone, 60 r.p.m.; fanning mill, 225 r.p.m.; elevating grain, 90 to 180 r.p.m. Under high-speed operation fall: Sawing wood, 1,100 r.p.m.; grinding feed, 700 r.p.m.; ensilage cutting, 800 r.p.m.; threshing, 1,000 r.p.m.; husking, 800 r.p.m. In the variable-speed classification come: Churning, 60 to 100 r.p.m.; fanning mill, 200 to 300 r.p.m.; threshing, 800 to 1,200 r.p.m.; grinding feed, 600 to 800 r.p.m. These data give some idea of the fact that small utility motors must operate some machines at low speed, some at relatively high speed; the large utility motors must give the same type of service.

ADJUSTABLE SPEED FOR THRESHING

Adjustable speed is highly desirable and in fact imperative for threshing. W. J. Bryan, one of the farmers on the line, points out that too high speed on the threshing cylinder will crack the grain. The desirable speed depends on the moisture content of the grain. A speed of 900 r.p.m. to 1,100 r.p.m. is favored. Furthermore, a continuous speed is desirable, but this is difficult because the power demand fluctuates from 40 kw. to 10 kw. in a few seconds owing to the rate of feed and moisture. Similar conditions exist in threshing flax, depending on the feed, Senator Herman Schmechel, another Minnesota farmer, explains. Owing to the difference in the power and speed requirements of the threshing cylinder and blower in a threshing machine, it is possible that two motors might be desirable to insure the most satisfactory results, Prof. E. A. Stewart declares.

Several ways have been tried by the Minnesota committee to attain the most desirable speed for farm equipment when driven by motors. Among the methods employed have been (1) line shafts in the buildings where the equipment is used, (2) countershafts on the same frame with a portable motor, (3) speed jacks on the frame with the motor, (4) back-geared motor, (5) automobile transmission gear, and (6) low-speed motors.

It is most difficult, however, to arrive at the proper speeds for some machines by the use of line shafts or countershafts unless exceedingly large, clumsy pulleys are used on the driven apparatus and small pulleys on the motors and countershafts, so small, in fact, that they give trouble from the belt slipping.

The methods which have been used are those which the average farmer would attempt if he were to operate present farm equipment with motors; but a farmer cannot be expected to be a mechanical engineer and to toggle up jacks, line shafts and countershafts and keep them in good operating condition. With such expedients the motor may run all right, but if the farmer has a good deal of trouble in the operation of the rest of the equipment, then the blame will be laid on the electric service, and he will be dissatisfied. In fact, he will cease to attempt to use it for many purposes when he encounters trouble, and his neighbors will not adopt his methods.

Farm machines as at present developed have not been adapted to the most efficient belt speed, in the opinion of Prof. J. B. Davidson, project director of the Iowa experimental line. He has expressed the belief that a belt speed of 3,000 ft. per minute is desirable and would permit the use of more desirable pulley sizes. Mr. Zimmerman of the International Harvester Company also contends that there is no uniformity in belt speeds, which range from 200 ft. to 4,200 ft. per minute. The most desirable speed is 5,000 ft. per minute, but this speed would involve pulleys of unsatisfactory size. At present there are two ranges of belt speed in common use, namely, 2,600 to 3,000 ft. per minute and 3,250 to 3,500 ft. per minute.

While some dissatisfaction with leather belts compared with treated cotton or rubber belting has been voiced among farmers, Mr. Zimmerman has expressed the belief that they can be used with satisfaction if waterproofed, since they have relatively high adhesion, and need not be so wide as other types of belts. The committee is also considering the use of silent-chain drive.

These problems of adapting farm and barn equipment to electric drive must be met by manufacturers of farm equipment in co-operation with electrical manufacturers and must be solved so that the farmer can get the proper driving speed for his farm equipment without developing makeshift intermediate-speed devices. Encouraging prospects along this line have arisen since a conference in Red Wing this fall in which a representative of the Farm Equipment Manufacturers' Association and the N. E. L. A. representative of the electrical manufacturers agreed to work out a plan for co-operation. Possibly the situation may be handled by the equipment manufacturers providing proper gear ratios on belt-driven devices so that the machines can be connected directly or belted to the motor. The solution will involve a consideration of what the most desirable motor speed, belt speed, and pulley sizes for farm service are.

SOME SPECIFIC OBSERVATIONS ON THE RESULTS OF RED WING LINE

Certain interesting information has been gathered which may be passed on, not as comprising digested data, but simply raw facts. For example, in some performance tests conducted on the Red Wing line it was observed that more power was required to pump a gallon of water when the motor was belted directly to the pump jack than when driving through a line shaft, owing to the flywheel effect of the latter.

Using a 15-hp., single-phase motor to drive a 22-in. grain separator, 647 bushels of tough stacked oats were threshed in about five and one-half hours with an average consumption of 60 kw.-hr. The same motor when used to cut ensilage handled about 10 tons to 15 tons per hour with an energy consumption of approximately 1 kw.-hr. per ton, employing a 14-in. Papec cutter. This motor would not operate the cutter at full capacity, but it did operate it much faster than the farmer could feed the corn into the machine. When operating a Letz feed grinder with 10-in. burrs, the same motor ground about 40 bushels of oats in twenty-five minutes with an energy consumption of about 0.2 kw.-hr. per bushel.

The amount of energy consumed in some operations is surprisingly low. For example, cream separators have been used on many of the Red Wing farms with an energy consumption of about 2 kw.-hr. per month. A large Thor ironing machine has been used for one month at the home of B. I. Melin with an energy consumption of about 10 kw.-hr. When an individual

motor-driven cream separator was employed, it is reported that only 7 kw.-hr. was consumed, operating the separator three months at 40 gal. a day.

On Mr. Cady's farm a 5-hp. utility motor (listed in Table II in the first installment of this article, published December 13, page 1256) has been used for pumping water, mixing concrete and sawing wood. It has been found in some of these applications that it would be much cheaper to put a back gear or speed reducer on the driven machine than to provide some flexible transmission between the motor and the driven apparatus adaptable to each case. To operate the wood saw most satisfactorily, it will be necessary to put a larger pulley on it and at the same time increase the saw diameter to get the desired depth of cut. For operating the threshing machine a 15-hp. motor with its own portable transformer has been mounted on angle-iron frames at one end of the thresher with pulleys 9 ft. center to center.

skids at W. J. Bryan's farm. This motor operates at 440 volts supplied from a 15-kva. portable transformer with a booster. The motor has a starter and a long cable that can be connected with the portable transformer which is attached to the primary line. Operating the ensilage cutter at full capacity, the motor is greatly overloaded, possibly because of insufficient flywheel effect, and the voltage is considerably reduced during overload.

At Mr. Melin's homestead the primary circuit is run into the center of the farm to the distribution transformer, thereby avoiding a considerable voltage drop. It is expected that this practice will be followed in the future. The 3-hp. motor is used simultaneously for fanning wheat and succotash and grinding feed. As much as five and one-half sacks per hour have been handled.

Adaptation of electric drive to water pumping has

EXAMPLES OF FARM APPLICATIONS

At left, transformer set up in center of farmstead. In center, feed grinder and fanning machine both being driven by portable motor. At right, motor on skids pumps water or saws wood.

To protect the motor from chaff it was necessary to make a cover for it, but it has been impossible to get sufficient ventilation with this cover in place.

On A. C. Bryan's farm the portable 5-hp. motor has been used to operate a feed grinder and grain elevator, the skids being fastened to the floor with stage screws and energy being carried to the motor through a portable cable. Experience on this installation has emphasized the undesirability of vertical belt drives. With this equipment it has been possible to elevate one wagon load of grain in six minutes. In operating the hay hoist it has been found that greatly differing motor speeds are required to start, hoist and carry a load of hay into a barn. With a 5-hp. motor a ratio of almost eighty to one is necessary, whereas increasingly lower ratios and higher speeds are required for lifting and transporting the load into the barn. It is possible that a motor-driven chain hoist running on a rail will find application in this service.

On A. Nelson's farm portability of the 3-hp. utility motor has been obtained by using a small four-wheel truck instead of skids. Safety switches remove any hazard. Using this equipment to grind barley, about six bushels per hour can be handled, whereas rye takes more power.

Ensilage cutting and silo filling have been accomplished simultaneously with a 15-hp. motor mounted on

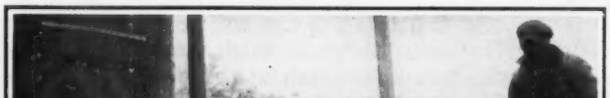
been accomplished on the farm of Mr. Miller without changing the pump head. The pump is operated with a slow-raise and quick-return mechanism, using a ¼-hp. motor. With the milking machine installed three cows can be milked at a time, permitting eighteen cows an hour to be handled. The farmyard lighting is controlled from the barn and house, and lighting in the farm buildings is segregated to facilitate flexible control.

Rural Lines in Transitory Stage

Investigation of different types of high-tension service lines has led to some interesting results in Minnesota. The Red Wing line as originally constructed consisted of one copper cable (three No. 8 twisted conductors) and a ¼-in. iron messenger wire for 2,300-volt, single-phase service. The messenger wire was grounded with an iron wire coiled below the bottom of each pole. In order not to ground the substation transformers, a 15-kva. one-to-one transformer was connected between the 2,300-volt county line and the experimental farm line. The experimental line had a total length of 6.3 miles, but the longest run to any one farm is four and one-half miles. Complete metallic lines from the substation to the point where the experimental line commences contain about one mile of No. 2 copper and 2.3 miles of No. 6 copper. Considerable industrial

load is connected to the No. 2 copper. This line was very inadequate. Operating a 5-hp. motor one day at the end of the line, it was observed that a potential of 130 volts existed across the terminals instead of 220 volts. Investigation showed that a drop of about 20 per cent existed through the one-to-one transformers when the high line was carrying a load of 10 kva. to 12 kva. This transformer was replaced by two 25-kva. transformers connected with the low sides together.

After this change was made an attempt was made to operate a 15-hp. motor from the line, but it would not



CUTTING ENSILAGE AND FILLING SILO SIMULTANEOUSLY

pull its full load. Investigation showed that about 20 per cent of the high-line potential drop was through the copper and 80 per cent through the return. Further investigation proved that with the ground saturated from recent heavy rains the ground was not even carrying 0.1 amp. when there was a load of 15 amp. on the high line. Under this load a double-transformer arrangement caused about a 10 per cent drop. The line was rebuilt, the ground returns being abandoned and the iron returns being replaced by three No. 8 twisted copper wire, and was connected directly to the 2,300-volt metallic lines. The two transformers were eliminated.

This line has more copper than probably any farm line in the country. Nevertheless, it is not satisfactory for operating the 15-hp. motor. When ranges on the line are in operation, it is impossible to carry any overload on the motor. A brake-horsepower test showed that the motor could never carry 16.4 hp. without the voltage falling below the critical point and causing the motor to stall. As a result it has been concluded that a 2,300-volt, single-phase line of three or more miles in length is not satisfactory for motors of 15 hp. along with other farm service. To remedy the situation, a 10 per cent booster transformer was placed in series with the step-down transformer. At no load the voltage at the 440-volt motor was 548 volts, whereas it was 500 volts when taking 8 kw. into the motor. Owing to the high potentials, the booster was adjusted to give only 5 per cent increase in voltage. Still, five house lamps and one stove element have been burned out in one month by the overvoltage. The no-load and light-load voltages are too high, whereas the voltages dropped about 20 per cent when a 15-hp. motor was connected.

On the basis that rural service should provide a sufficiently large load to insure low rates and at the same time justify the utilities in giving electric service, some utility men believe that rural lines should be laid out with a view toward using ultimately a higher voltage (possibly 6,600 or 13,000) and three-phase service, starting with 2,200-volt, single-phase, for light loads and possibly raising the voltage as well as adding a third wire for three phases if larger loads are to be connected. If this is to be the ultimate outcome, the selection of farm motors will have to be made accordingly and in any estimate of the cost of serving farmers this must be taken into consideration.

Already it is quite generally concluded that until the rural-service study affords more definite conclusions regarding the nature and magnitude of rural loads, no definite steps can be taken to determine the kind of transmission lines which will be required. Investigation so far indicates that if energetic steps are taken to develop rural loads on an economical basis, rural service cannot longer be considered as a small scattered load that can be served only from cheaply constructed lines. On the other hand, rural loads may be developed to the point where they will simulate scattered loads from small factories and will require lines capable of handling such loads. Meanwhile, it behooves utilities to consider rural loads in a new light.

FINANCING AND RATES

Owing to the fact that the average cost of serving 4,000 farm installations throughout the country is about $8.75 per customer per month, assuming 1.8 to 3.4 customers per mile, the Minnesota committee started on the basis that rates should be such that the utility will lose no money under any consideration and that farmers will be encouraged to use the maximum amount of energy. Consequently, a rate was adopted and is in force on the Red Wing line consisting of a fixed charge (including interest on the line, depreciation, maintenance, meter reading and bookkeeping, taxes, insurance and trouble shooting) and a straight energy charge. The fixed charge, based on three customers per mile and an estimated expense of $1 per customer per month for core losses, was put at $6.90 per customer per month. For the first 30 kw. used 5 cents per kilowatt-hour is the energy charge, and for all over this amount the charge is 3 cents per kilowatt-hour. This rate is based on installing a 3-kw. transformer, but provision is made for increases in demand. Prof. E. A. Stewart, project director of the Red Wing line, who has made a thorough study of rural service rates from all angles, presented an extensive paper on this subject in the early part of the year 1924 before the Society of Agricultural Engineers.

In Minnesota the State Committee on the Relation of Electricity to Agriculture favors the utility company financing the line in order that the farmers shall have money for buying farm and electric equipment with which to utilize the energy available. The foregoing rate is based on this condition. If farmers insist on financing the line to save the 8 per cent charge as interest on investment, the fixed charge of the rural-service rate is reduced to $4.76 per customer per month. However, the committee, for various reasons, urges the farmers to purchase utility securities bringing 8 per cent returns in place of their financing the line. With the rates in force, the small user of electricity will, of course, have to pay a high rate, namely, 28 cents per kilowatt-hour for 30 kw.-hr. per month. However, if the consumption is increased to 100 kw.-hr. per month, the rate automatically reduces to 10½ cents per kilowatt-

hour, and if it reaches 520 kw.-hr. per month, as it has on W. J. Bryan's farm, the rate is only 4½ cents per kilowatt-hour, thereby encouraging the use of energy on the farm.

COMMENTS OF RED WING FARMERS

The arrival of electricity on the Red Wing experimental farm has brought many benefits which, according to the comments of some of the farmers, cannot be measured by labor records or cost accounts. One young woman was asked: "Does electricity help you in getting away from home?" She answered: "I guess so; I do my washing and ironing all in one day where it used to take one and one-half days and half a day of my father's time." The Minnesota committee expects through electric service to help her accomplish the whole job in half a day before long.

One of the farmers was just about ready to give up the farm because of its drudgery and inconvenience. Electricity now provides hot water for his bath, water at the barn for his stock, cooks his meals and lights his journey through life. Another family discouraged with farm life is now getting along without the troubles incident to the "hired girl." Electricity helps do the housewife's chores.

A farmer who uses both electrically operated and oil-operated incubators has observed that 55 per cent of the eggs hatched in the oil-operated one and 77 per cent in the electric one. He also reports that there are more cripples in the oil-operated machine.

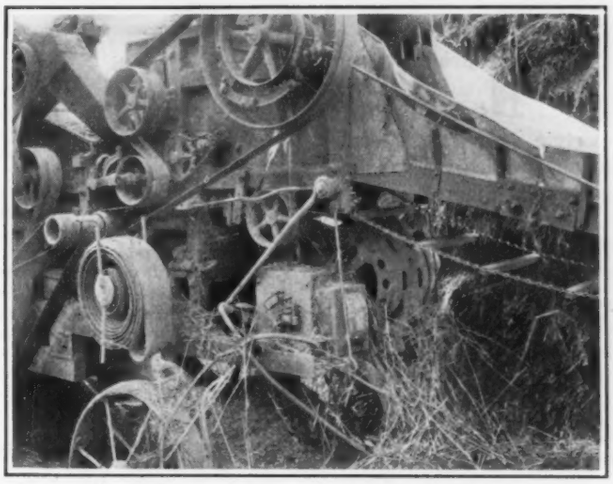
Still another farmer says that even with the makeshift experimental electrical applications already installed on his farm he will be able to handle all of the farm work without requiring any help besides that of his two sons.

As to the cost of the electrical equipment, one man says that he would not part with it, now that he has seen what it can do, if he had to pay full-list price for it. This farmer has about $1,600 worth of electrical equipment installed.

VALUE OF ELECTRIC TILLAGE UNCERTAIN

At the recent conference in Red Wing the subject of electric tillage came up for considerable discussion. While no optimistic expressions were indulged in, it was generally concluded that the economy and practicability of applying electricity to all farm operations should be considered and proved or disproved by investigation. Professor Stewart pointed out that it is very important that the large motors required on farms should be used continuously to keep down the peak demand, to utilize the transformers most effectively and to get the biggest return from the investment in equipment. If motors which are used for threshing, ensilage cutting, etc., could be used for tillage and other operations whose demands do not come at the same time, such requirements might be met. He asked earnest consideration of the possibility of motor-driven tractor plows carrying a cable reel or plows operated by general-utility motors.

Dr. E. A. White, director of the national committee, expressed the opinion that present electric tillage methods do not take full advantage of electricity. He thought, however, that electric tillage cannot be applied to anything but small areas. In this Prof. J. B. Davidson of Iowa concurred, saying that electric tillage might be applicable to truck farming and telling how he built an experimental garden tractor operated by a 3-hp., three-phase motor fed through a 600-ft. cable, the motor being installed on skids at one side of the field. Sixty-five per cent efficiency was obtained in this manner, compared with 35 per cent where the motor is installed on a tractor. Possibly the operation can be made automatic and labor and investment reduced. Opinions were expressed to the effect that motors adapted to traction are not applicable to other farm operations, but K. A. Pauly of the General Electric Company contended that this is not the problem. If the various committees on the relation of electricity to agriculture wish to see electricity adapted to the large bulk of power applications on the farm, horses and tractors must be displaced, it is contended. While not much hope was entertained that storage-battery tractors will prove feasible and economical on farms, the opinion was held by several that this new field of application should be seriously considered to prove or disprove the value of the electric storage-battery tractor in this service.



MOTOR DRIVE APPLIED TO A THRESHING MACHINE—CRUDE, BUT A START

Novel Electric Ferryboat in Operation on the Willamette

A UNIQUE application of electric power is found in an electrically driven ferryboat operating on the Willamette River at Independence, Ore. The boat is driven by a 20-hp., 440-volt, three-phase motor, connected to side wheels through a Fordson tractor transmission, giving high and low speed and reverse. Four-hundred-and-forty-volt power is supplied by the Mountain State Power Company, Albany, Ore., to a trolley circuit consisting of three ⅜-in. Siemens-Martin galvanized-steel cables stretched 1,200 ft. across the river. Trolley wheels supported on a pantograph and a three-conductor flexible cable complete the electrical connection to the motor. The electric drive replaces a gasoline engine with propeller.

Under the old system of gas-engine drive a round trip took from fifteen to thirty minutes, the operating cost averaged $150 per month, and there were frequent tie-ups for repairs. With the electric drive the ferry operates continuously and can make a round trip in less than five minutes. Over a period of five months, during the busiest season of the year, the power cost has averaged $60 per month. The ferry is owned by adjacent counties and renders free service.

Lamp Efficiency and Life Tests*

Consistent Results from Tests at Different Efficiencies—Bureau of Standards Finds Lumen and Efficiency Values — Average Life Efficiency Bears Constant Ratio to Initial Efficiency

By J. F. SKOGLAND† and J. FRANKLIN MEYER‡
Bureau of Standards

THIS paper summarizes results of life tests at the Bureau of Standards on vacuum tungsten-filament incandescent electric lamps, tested at different efficiencies in lumens per watt, so chosen that the average life of different lots of lamps on the test racks was approximately 300, 400, 500, 800, or 1,000 hours respectively. Lamps were taken from the regular life-test lamps selected by the lamp inspector in the field and were grouped into lots so that lamps of the same size and brand were represented on two or more test lots. Results are given for tests extending over three years and are tabulated in a way to show the agreement in values for average efficiency and light output on the basis of each test criterion in hours' life. Consistent results were obtained, irrespective of the length of the test life.

MOST of us are prone to consider the incandescent electric lamp as a rather inconsistent and variable piece of apparatus when compared with other electric devices. Such a conclusion might be somewhat justified if we limited our observations to individual lamps comparing each lamp with its neighbors in point of light output, efficiency and life. Since, however, even the slightest consumer requires a group of lamps to light his home or shop, the average service of the group is the matter of prime importance, and it is a logical and worth-while procedure to investigate and test such groups, expecting, of course, greater consistency of results for the group than for the indiviual lamp.

It is a function of the testing laboratory to determine the average light output and efficiency in lumens per watt during life of groups of lamps and to compare these values with those required in the specifications under which the lamps are purchased. Despite notable progress in manufacturing methods, leading to a marked advance in point of consistency in life and lumen maintenance among the individual lamps of a group, it is still necessary to include in the specifications allowable tolerances for test groups of various sizes, these tolerances being larger for the smaller groups. The testing laboratory also undertakes to save time and expense by burning lamps on test at efficiencies higher than those found at the rated or normal service voltage. Here, then, the question arises as to how closely the actual performance curves of lamps when burned at normal service voltage are reproduced when sample test lots are burned at these higher test efficiencies. In laboratory testing of lamps we have not only the variables inherent in the lamps themselves, but also the possibility that the performance curves will be distorted by burning at the higher efficiencies, so that the true average values of lumens and efficiency during life at normal rated efficiency may not be directly obtained by the tests.

The Bureau of Standards began a study of these questions soon after the adoption of the specifications now in use.|| In the ninth edition of the specifications for large incandescent electric lamps, issued July 30, 1921, noteworthy changes were made in the test procedure specified for tungsten lamps. The long-established provision that the life of test lamps should be considered as ended when the candlepower had fallen to 80 per cent of the initial value was abandoned and a new test procedure inaugurated based on total life to time of burn-out. The performance of a lamp throughout its test life to burn-out was also taken into account in these specifications through two other provisions. One of these is the evaluation of life-test results on the basis of average efficiency throughout life, as well as on the initial efficiency; the other is a requirement that the average light flux during the life of a lamp must not fall below a specified percentage of the initial flux. Another feature is the establishment of a series of tolerances to allow for possible variations in test results arising from the fact that small numbers of test samples may not represent fairly the average quality of the lamps from which the test lamps are selected.

Based upon a long series of tests under previous specifications, certain test criteria had been derived. These criteria include the initial test efficiencies and the corresponding hours' life. If, for example, it is found desirable to make a test of a group of lamps in, say, 400 hours' or 500 hours' burning, instead of the rated 1,000 hours of the specifications, a predetermined initial efficiency can be assigned for each size and type of lamp and the lamps put on burning at this efficiency. The 400 hours' or 500 hours' test life is called the "criterion" for the test. Readings of lumens and efficiency are then taken at periods corresponding to four-tenths and five-tenths of those used on the normal 1,000-hour basis. A series of tests begun in 1922 to determine the test criteria for lamps of present-day manufacture has been continued through the government fiscal years 1923 and 1924. Both regular and special selections of lamps were tested during the last two years. As the total number of vacuum tungsten lamp run on these tests now exceeds 2,000, it is felt that the results are conclusive and worthy of publication. Tests of a similar nature on about 850 gas-filled lamps are in progress.

All of the tests of this report were made on lamps regularly selected by the bureau inspector at the factories of three manufacturers supplying lamps under contract to departments of the government, and the

*Published by permission of the director of the Bureau of Standards. †Associate physicist. ‡Physicist.

||The first specifications for government testing and inspection of lamps were issued in 1907. The specifications now in use, Standard Specification No. 23 of the Federal Specifications Board, are published as Circular 13 of the Bureau of Standards (Tenth edition), issued February 7, 1923.

TABLE I—RELATION OF AVERAGE EFFICIENCY OF LAMPS DURING LIFE TO THEIR INITIAL EFFICIENCY

The average efficiency is shown as a percentage of the initial efficiency for each group of lamps. (S) = special groups; (R) = regular tests.

	Criterion Chosen (in Hours)									
	300		400		500-600		800-900		1,000-1,100	
	No. of Lamps	Per Cent Average Efficiency	No. of Lamps	Per Cent Average Efficiency	No. of Lamps	Per Cent Average Efficiency	No. of Lamps	Per Cent Average Efficiency	No. of Lamps	Per Cent Average Efficiency
25-watt:										
(S) 1922	46	91.9	..	....	46	93.0	45	91.8	..	....
(R) 1923	68	92.8	199	93.6	55	94.7	..	....	..	....
(S) 1924	33	94.7	..	....	34	93.5	33	94.8	..	....
40-watt:										
(S) 1922	..	....	56	88.1	56	87.9	..	....	57	87.7
	..	....	..	....	19	90.4	21	89.0	..	....
	..	....	45	87.7	44	87.7	42	88.7	..	....
(R) 1922	..	....	19	89.6	148	88.7	..	....	..	....
(R) 1923	166	87.6	180	87.4	167	87.5	..	....	..	....
(S) 1924	39	91.8	..	....	38	91.7	39	92.0	..	....
60-watt:										
(S) 1922	..	....	43	84.3	42	85.2	..	....	40	84.7
(S) 1923	59	83.1	..	....	59	82.9	..	....	..	....
(R) 1923	..	....	95	83.0	..	....	..	....	..	....
(S) 1924	15	86.3	..	....	15	88.3	15	87.7	..	....

results were included with those of the tests regularly run and reported in the interest of the manufacturers and of the government. The tests here separately summarized and reported are the result of special groupings of lamps taken from the regular product of the manufacturers selected for routine life testing. The special groupings designated in the table were made in the following manner.

Lamps of a single shipment from the inspector in the field were grouped by item numbers which appear on the life-test labels. In the case of selections for two criteria alternate lamps of the same size and brand were selected for each test: that is, lamps No. 1, 3, 5, etc., for one criterion, and lamps No. 2, 4, 6, etc., for the other. For three criteria lamps No. 1, 4, 7, . . . 2, 5, 8, . . . and 3, 6, 9 constituted similar groups. In case the desired number could not be obtained from a single shipment, similar selections from later shipments were made and added to the groups. This is, it is believed, a fair method of assigning lamps to test groups and represents as closely equivalent an assignment as can be made from the regular factory product. The regular tests under different criteria were not so selected. Here the lamps of an entire shipment or a combination of several shipments were assigned to test under a single criterion. Two cases in which the regular tests were run at periods between those chosen for the special tests are designated below.

This report includes all of the lamps run for the purpose mentioned. There are no groups or parts of groups omitted because of inconsistency or doubt as to the validity of the data. There is presented, in fact, a complete summary of all of the results, so that regular selections and special selections (see above), small groups and large groups and the work of one year and that of another may be compared. The small number of lamps in the 1924 special selections is accounted for by the fact that more lamps were not available at the time the tests had to be started.

Tables I and II show the results for mean efficiencies, in lumens per watt, only. The values of light output follow closely those of efficiency. For the 1924 tests the lumen values are in slightly better agreement on the average than those of efficiency. On a percentage basis there would be no significant difference between these tables and those which might be prepared to exhibit light output. This close conformity of light-output values to efficiency values merely indicates that the electrical characteristics of the lamps are negligibly affected by the changes in test criteria. It is felt, therefore, that nothing would be gained by including the light output summary in this report. The value of mean efficiency is of prime importance because it is a basis of life evaluation held by the specifications to be a measure of inherent quality.

Referring to Table I and selecting 25-watt lamps tested in 1923, it is seen that 68 lamps were burned on a 300-hour criterion, 199 lamps on a 400-hour criterion and 55 lamps on a 500-600-hour criterion, with efficiencies of 92.8 per cent, 93.6 per cent and 94.7 per cent

TABLE II—RELATION OF AVERAGE EFFICIENCY DURING LIFE TO INITIAL EFFICIENCY AS AFFECTED BY TEST EFFICIENCY

The ratios of average efficiencies to initial efficiencies are here expressed as a percentage of the mean for each test selection. A test selection includes the values in one horizontal line of the table. (S) = Special groups; (R) = regular tests.

	Criterion Chosen (in Hours)										
	300		400		500-600		800-900		1,000-1,100		
	No. of Lamps	Per Cent	No. of Lamps	Per Cent	No. of Lamps	Per Cent	No. of Lamps	Per Cent	No. of Lamps	Per Cent	No. of Lamps
25-watt:											
(S) 1922	46	99.6	..	....	46	100.8	45	99.5	..	....	137
(R) 1923	68	99.1	199	100.0	55	101.2	..	....	..	....	322
(S) 1924	33	100.4	..	....	34	99.1	33	100.5	..	....	100
Means	147	99.55	199	100.0	135	100.5	78	99.9	..	....	559
40-watt:											
(S) 1922	..	....	56	100.2	56	100.0	..	....	57	99.8	169
	..	....	..	....	19	100.8	21	99.3	..	....	40
	..	....	45	99.65	44	99.65	42	100.8	..	....	131
(R) 1922	..	....	19	100.9	148	99.9	..	....	..	....	167
(R) 1923	166	100.1	180	99.9	167	100.0	..	....	..	....	513
(S) 1924	39	100.0	..	....	38	99.9	39	100.2	..	....	116
Means	205	100.1	300	100.0	472	100.0	102	100.3	57	99.8	1,136
60-watt:											
(S) 1922	..	....	43	99.5	42	100.55	..	....	40	100.0	125
(S) & (R) 1923	59	100.1	95(R)	100.0	59	99.9	..	....	..	....	213
(S) 1924	15	98.7	..	....	15	101.0	15	100.3	..	....	45
Means	74	99.8	138	99.85	116	100.3	15	100.3	40	100.0	383
Means of all	426	99.8	637	100.0	723	100.15	195	100.1	97	99.9	2,078

respectively of the initial rated efficiency. Table II, in which the results of Table I are expressed as percentages of the mean values for each test selection, shows that the three lots of this selection, tested at initial efficiencies corresponding to the three life criteria above, gave results which deviate from the mean for the three lots by a maximum of 1.2 per cent. The deviations from the means are smaller, and in general well under 1 per cent, for the other lots in the table with one exception—the small group of fifteen 60-watt lamps designated as S-1924, where under the 300-hour criterion a deviation of 1.3 per cent occurs. There is every reason for inferring that the results for other sizes of vacuum tungsten lamps are fully as consistent when tested under these life criteria.

CONCLUSIONS

The very consistent comparative results for the groups of a given test selection run under different test criteria, and the average results for each size and for combinations of the three sizes meet the most exacting requirements of life-test work. It is safe to conclude, therefore, that the average efficiency and light output during life may be directly determined by tests based upon an initial efficiency corresponding to any test criterion within the range included.

The initial efficiencies corresponding to the various test criteria for vacuum tungsten lamps have been well established and are verified from year to year by tests at the Bureau of Standards and at the laboratories of the largest manufacturers, so that a report of life values under different criteria would include nothing new. For this reason these values are not given in this paper. It may be of interest, however, to note that if the average efficiency during life is found to bear a practically constant ratio to the initial efficiency under the various test criteria, as is the case for the tests of this report, the established factors which are employed to determine from the average life of the test lamps the equivalent life at any desired initial efficiency within the range of the criteria employed apply equally well on the mean efficiency basis.

High-Pressure Station on Ohio

Miami Fort Plant Built for Turbine Water Rate of 7.67 Lb. per Kilowatt-Hour, Using 600-Lb. Pressure and Two 40,000-Kw. Tandem Turbines Tapped at Four Points—Powdered Fuel, Air Preheaters and Unique Boiler-Room Equipment

NUMEROUS interesting features will be incorporated in the Miami Fort generating station of the Columbia Power Company, which is being erected on the Ohio River approximately 20 miles west of the center of Cincinnati and three-quarters of a mile east of the mouth of the Great Miami River. At this point the variation in river stage is about 64 ft.

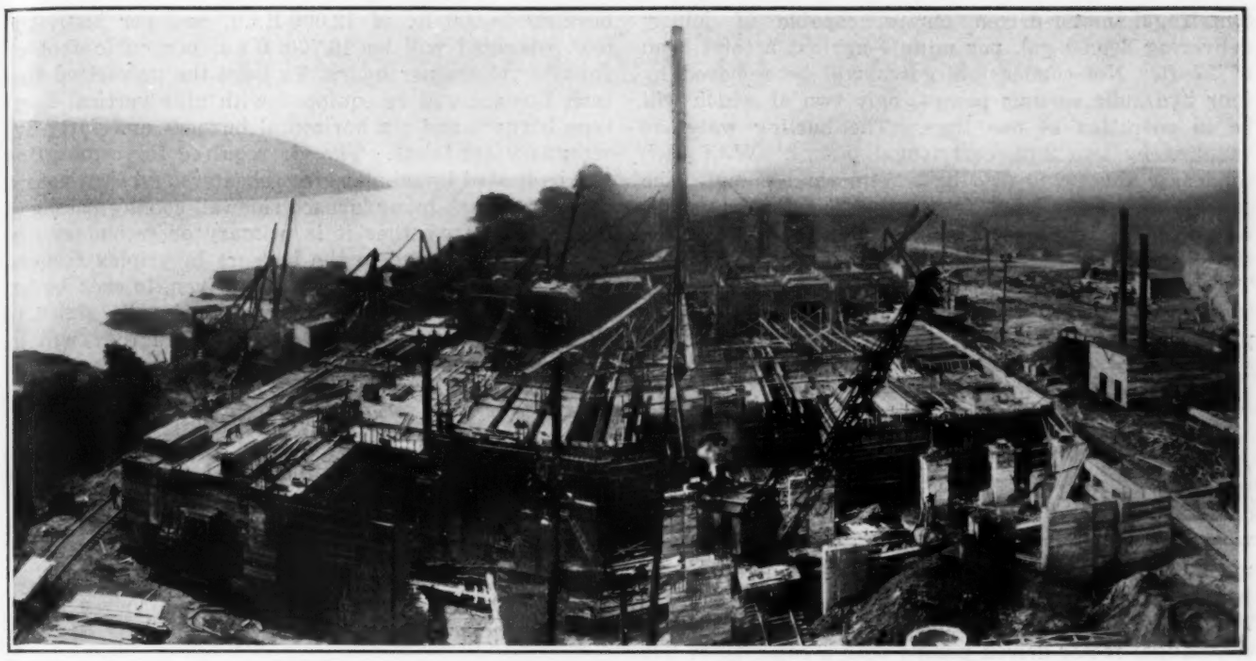
Foremost in the interest of engineers will probably be the provisions for using 600-lb. (gage) steam at a total temperature of 750 deg. F. Other outstanding features include the use of 40,000-kw. tandem turbines bled at four points, vertical inclined-surface condensers, "reheat" boilers and economizers, tubular air preheaters and furnace-wall ventilation, combined vertical and horizontal pulverized-fuel burners, pulverized coal-fired rotary driers, electro-pneumatically controlled coal valves, effective combination of feed-water heaters and de-aërators and unusually large circulating-water screens. Information on these and other features has been received from C. W. De Forest, vice-president of the Columbia Power Company. Virtually all of the substructure work and deep work on the tunnels is completed (as shown in the accompanying illustration). The steel supporting the turbine foundations has been erected in the condenser well. Work on the superstructure has been under way for some few weeks.

The turbine room is perpendicular to the river, the boiler room being to the east and parallel to the river. Parallel to and along the west side of the turbine room, under the switch house, are the intake and discharge tunnels, which will be ample to serve six to eight 40,000-kw. each units. When additional units are added the tunnels and turbine room will be extended back from the river and additional boiler capacity provided in the aisles parallel to the original boiler room. This arrangement will allow for any changes in the sizes or type of equipment to be added in the future.

Two rows of four traveling screens each (82 ft. 6 in. between vertical centers) are installed for all condensing water passing through two sets of screens. The heavier foreign matter will be removed by stationary grids ahead of the screens, and the débris collecting in front of the grill will be removed by a bucket crane, one end of which will be pivoted, thus allowing the other end freedom to travel in a semicircular track. A 48-in. pump installed in the crib house will permit pumping water from the discharge tunnel to the mouth of the intake tunnel to melt any drift ice that may collect on the screens.

DESCRIPTION OF TURBINES

Two 40,000-kw. tandem turbines (four stages high pressure, twelve stages low pressure) will be installed initially to operate at 550 lb. (gage) and 725 deg. F. total temperature. They are, however, designed for 600 lb. and 750 deg. F. The turbines will be tapped at the fourteenth, eighteenth, twenty-second and twenty-fourth stages. Exhaust from the fourteenth stage is passed to the reheating boilers at 120 lb. absolute pressure, 424 deg. F. total temperature, and returned to the fifteenth-stage nozzle bowl at 110 lb. absolute pressure and 725 deg. F. total temperature. Steam from the twenty-fourth stage will be utilized in the low-stage vertical open heater. That from the twenty-second stage will be utilized in the intermediate closed heater (1,150 sq.ft. heating surface), the steam space of which will be vented to the low-stage heater. The leakage from the high-pressure packing will be passed through a desuperheater to the gland heater of the closed type (1,020 sq.ft. heating surface), the steam space of which will be vented to that of the intermediate



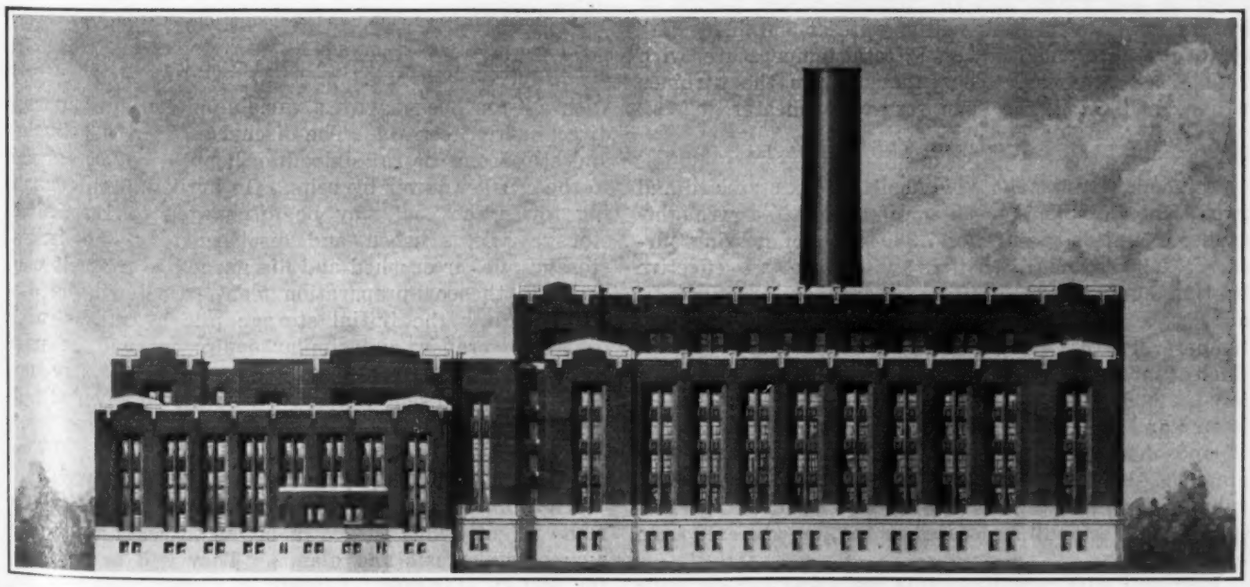
PROGRESS VIEW OF NEW 80,000-KW. POWDERED-FUEL PLANT IN OHIO

feed-water heater. The steam extracted from the eighteenth stage will be utilized in an open feed-water heater. With the exception of the latter, which will be near the boiler-room roof, the heaters will be installed in the turbine-room basement. The approximate quantities of steam to be extracted, the pressures and qualities of the extracted steam and the temperature of the feed water entering and leaving the heaters will be as shown in the accompanying table. When operating at full load without extraction and returning the leakage from the high-pressure packing to the twenty-second-stage shell, the water rate of these turbines will be 7.67 lb. per kilowatt-hour, according to guarantees.

The main generators will be rated at 44,705 kva., three-phase, 60 cycles, 13,200 volts, and their respective exciters and auxiliary generators will be mounted on the same shaft. The auxiliary generators are rated at 2,860 kva., 2,300 volts, and the exciters at 270 kw., 250 volts.

Ventilating air for the main and auxiliary generators will be cooled by surface air coolers. Each main generator cooler has six main and six auxiliary sections, while the auxiliary generator coolers will have one main section each. The main sections are arranged so that the circulating medium may be either condensate or service water, whereas the auxiliary sections will take only service water. Arrangements have been made for injecting inert gas into the cooling-air ducts for fire protection of the generators.

Vertical inclined-surface condensers, having 48,000 sq.ft. of condensing surface each, will be installed, but the tube sheets will be drilled to receive a maximum of 50,000 sq.ft. of tube surface. Circulating water for each unit will be supplied by two 30-in. horizontal



EXTERIOR VIEW OF MIAMI FORT STATION WHEN COMPLETED

centrifugal motor-driven pumps, capable of jointly delivering 60,000 gal. per minute against a total head of 27 ft. Non-condensible gases will be removed by four hydraulic vacuum pumps, only two of which will be in operation at one time. The hurling water is supplied by two 8-in. centrifugal pumps. With each condenser there will also be a 6-in. sand pump. The condensate is taken from the condenser shells by primary hot-well pumps and forced through the generator air coolers to the low-stage heaters. The discharge from the low-stage heaters returns to the secondary hot-well pump in the condenser pit. These pumps force the water through the intermediate heater and gland heater to the open feed-water heater near the top of the boiler room. The primary hot-well pump system will consist of two 5-in. two-stage centrifugal motor-driven pumps with a capacity of 800 g.p.m. each against a total head of 175 ft. The secondary hot-well-pump system will be two 5-in. two-stage horizontal motor-driven centrifugal pumps, rated at 800 g.p.m. each against a total head of 300 ft.

DATA ON FEED WATER HEATERS

Heater	Per Cent Extraction	Pressure Lb. Abs.	Quality	Temperature Water, (Deg. F.) In	Out
Low-stage...	5.41	2.95	1.0% moist	75	130
Intermediate	2.80	9.70	77° F. superheat	130	173
Gland.....	1.38	14.00	600° F. superheat	173	195
Open.....	2.61	40.00	240° F. superheat	195	240

When supplied with circulating water at 60 deg. F. at the rate of 60,000 g.p.m., and with full load, the condensers will be required to maintain an absolute pressure of 1.05 in. mercury.

Water from the open feed-water heaters will flow by gravity to de-aërators at a temperature of 240 deg. F., leaving at 215 deg. The pressure within the de-aërators will be 15.6 lb. absolute. The non-condensible gases will be normally discharged to the atmosphere by the pressure within the de-aërators, but two vacuum pumps will be provided to cut in automatically if the temperature should fall below a predetermined limit.

Four motor-driven and two turbine-driven six-stage boiler-feed pumps will be installed, capable of pumping against a head of 680 lb., the motor-driven pumps being rated at 400 g.p.m. and the turbine-driven pumps at 500 g.p.m. The turbines will operate at 550 lb. (gage) steam pressure and 725 deg. F. total temperature, with 10-lb. back pressure. The exhaust from the turbines will be utilized in the open feed-water heater.

BOILER EQUIPMENT AND FURNACES

The boiler equipment will consist of six standard and two "reheat" boilers, each equipped with a wrought-steel economizer containing 7,300 sq.ft. of heating surface. The standard boilers will have an effective heating surface of 15,110 sq.ft. each and 2,640 sq.ft. of superheating surface, capable of raising the total temperature to 740 deg. at 570 lb. pressure (gage). Each reheat boiler will consist of a 650-lb. boiler having 6,060 sq.ft. heating surface, a 1,610 sq.ft. superheater and a 17,275-sq.ft. reheat section mounted above it and designed to take steam from the fourteenth stage of the turbine and reheat it to 725 deg. F. A tubular air preheater having 9,888.5 sq.ft. of external heating surface will be located in the flue-gas exit from each furnace.

Furnaces with ventilated side walls and ash-pit walls having a volume of 12,931 cu.ft. will be provided. When burning 18,000 lb. of 12,000-B.t.u. coal per hour, the heat liberated will be 16,700 B.t.u. per cubic foot of furnace volume per hour. To burn the pulverized fuel each furnace will be equipped with nine vertical flare-type burners and six horizontal burners and forty-five secondary air inlets. The air required for combustion will be heated by tubular air preheaters and then passed through the ash-pit or furnace sidewall cooling passages, depending on whether it is primary or secondary air. The fuel will be fed to the burners by triplex feeders, of which there will be five, motor-driven, to each boiler. Ashes will be removed through a hydraulic sluice to the east end of the boiler room, where they will be handled by bucket cranes. In the coal-preparation plant, adjoining the boiler room, coal will be dried in two 6-ft. 6-in. x 50-ft. indirect pulverized-coal-fired rotary driers. The coal will be pulverized by six 57-in. gear-driven screen-type mills and transported to the individual boiler hoppers by three 6-in. and two 10-in. pumps. The valves in the transport lines will be electro-pneumatically controlled from a central switchboard.

Arrangements wil be made to receive coal either by rail (Baltimore & Ohio Railroad) or by river barge. For the latter a tower on the river pier is equipped with a 4-ton bucket with a variable alternating-current direct-current control. The discharge from this bucket and also from the rail-unloading hopper will be carried to the crusher tower by belts. On arrival at the crushing tower the coal may be discharged to the initial storage pile, crushed and discharged to the initial storage pile, or crushed and discharged to the belt conveyor to the coal-preparation plant. Coal will be distributed over the initial storage pile by means of a drag-line scraper, and similar equipment will be used for reclaiming crushed coal to the tower. The tail blocks for the drag scraper will be mounted on a tail-block car, which will be moved by a motor on a track bounding the coal-storage area on three sides. When piled 20 ft. high 122,000 tons of coal can be stored.

High-pressure steam and boiler-feed valves will be made of steel with forged monel-metal seats and disks, monel-metal stems and glands. They will be designed for 900 lb. standard. Sargent & Lundy, Chicago, Ill., are the engineers.

MAKE OF EQUIPMENT USED

Mechanical

Traveling screens—Chain Belt Company.
Cranes for handling circulating-water débris and for turbine room—Whiting Corporation.
Condensing equipment and pump between discharge and intake—Worthington Pump & Machinery Company.
Cast-iron pipe—Pittsburgh Piping & Equipment Co.
Main turbines, condenser auxiliary motors and air coolers—General Electric Company.
Feedwater heaters and de-aërators—Elliott Company.
Vacuum pump for de-aërators—Nash-Hylor Company.
Boiler-feed pumps—Cameron Steam Pump Company.
Boiler-feed pump turbines—Terry Steam Turbine Company.
Boilers, superheaters, economizers, air preheaters and receiver separators—Babcock & Wilcox Company.
Furnaces—M. H. Detrick Company.
Pulverized-fuel equipment—Fuller-Lehigh Company.
Draft fans—Buffalo Forge Company.
Coal-handling equipment—R. H. Beaumont.
High-pressure and boiler-feed valves—Lunkenheimer Company.

Electrical

Main generators, exciters, auxiliary generators—General Electric Company.
Boiler-feed-pump and draft-fan motors—Allis-Chalmers Manufacturing Company.
Main switchboards, oil circuit breakers, motor generators and 13,200/66,000-volt transformers—Westinghouse Electric & Manufacturing Company.
Direct-current circuit breakers—Cutter Electrical & Manufacturing Company.
Disconnecting switches and choke coils—Champion Switch Company.
Storage batteries—Gould Storage Battery Company.

Electrical Heat in Industry

Basis for Bringing Conviction of the Value of Its Application—A Discussion Particularly Addressed to Industrial-Plant Men, Although Power Salesmen May Derive from It Suggestions for Arousing Increased Interest

By WIRT S. SCOTT
Manager Industrial Heating Section, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

IF A HUNDRED men connected with electrical industries were picked at random and asked what they think about industrial applications of electric heat, ninety-nine would say that it is unquestionably the ideal method of heating but it costs too much. Comparatively few realize that electric heat is commercially economical. At present there is installed and in daily use an industrial heating load equal to more than one-tenth of the motor load. This apparatus had to compete with fuel-fired equipment on the basis of over-all costs, and still it has demonstrated its superiority in practically every operating phase. It has shown that with high-grade apparatus, properly applied, there is every reason to expect a lower cost of production.

Approximately 1,250,000 kw. of electric heating apparatus is installed in the United States. Of this, more than 1,000,000 kw. is on central-station lines. From statistics gathered from central stations the connected load for different groups and the revenue produced were compiled and are given in the table:

CENTRAL-STATION CONNECTED LOAD AND REVENUE FROM APPLICATIONS OF ELECTRICAL HEAT

Apparatus	Kw. Installed	Annual Consumption, Kw.-Hr.	Revenue Produced
Steel-melting furnaces	225,000	305,000,000	$6,200,000
Brass-melting furnaces	95,000	290,000,000	4,700,000
Heat-treating furnaces	85,000	220,000,000	3,900,000
Industrial ovens	200,000	380,000,000	6,500,000
Bread-baking and commercial cooking	100,000	109,000,000	2,700,000
Welding	55,000	25,000,000	880,000
Miscellaneous small units	325,000	590,000,000	14,800,000
Total	1,085,000	2,119,000,000	$39,680,000

The application of industrial heat to industrial processes has been slow for very good reasons:

First—Because changes in established customs take place slowly, and rightly so. Fuel heating has been in use for hundreds of years. Users have become accustomed to certain conditions which have been adopted as standard, therefore they have been laboring under the impression that their operating conditions and the results obtained were entirely satisfactory. The same situation arose when the electric motor was developed to supplant other forms of motive power. An enormous amount of opposition and inertia had to be overcome before it reached its present state of application. The cost of operation based on the power bill was higher than the operating cost of steam or gas engines; hence the pioneers in this work were continually confronted with the opinion that electric motive power was too expensive and that it could not be made to compete with prevailing costs at that time.

In the development of industrial electric heating fields engineers may profit by the experience gained in the development of the electric motor applications. In every case where electricity has been introduced for industrial heating processes it has shown the user a new standard of comparison and has produced operating results and conditions not believed to exist. It has shown that electric heat is economical, that it produces a new standard of quality, that the most difficult operating conditions may be made simple by exact and reliable automatic temperature control, and that labor conditions are greatly improved.

Second—In any new field having great potential possibilities such as industrial heating there must necessarily be a large amount of investigation and experimental work done. There were no standards to go by, and there were a great many pieces of apparatus developed that should not have been. There were many applications that should not have been attempted at the time, and much time and expense were put into investigating and developing apparatus that subsequent developments showed was not justifiable. Later developmens altered these conditions, but it should be borne in mind that electric heating is not a panacea for the ills in heat treatment and should be applied only after a thorough analysis has been made of all conditions having a bearing on the final cost of the completed product.

However, after years of investigation, there has gradually been developed a line of standard apparatus for which there are large possible applications. There have been large numbers of so-called standard apparatus sold, and sufficient information has been accumulated to show conclusively the results obtainable.

Aside from the large heating problems that receive more or less attention on the part of the plant engineer, there are many applications of a minor character around the plant which are neglected and to which electric heat might be applied in a most economical manner. Many such applications have been made with a return on the investment and saving of labor that made the cost of power entirely negligible. Installations are in successful operation where the cost of electric power is from two to three times the former cost of heating, yet they are commercially economical because the finished product shows a lower over-all cost.

Standard electric heating apparatus applied to applications in general use produces certain results that might be said to be inherent with electric heat. These are: (1) Uniform high-grade quality of product; (2) increased production; (3) reduced expenditure for labor; (4) better working conditions; (5) lower over-all operating results.

Electric heat is the most flexible, the most definite and the most easily controlled form of heat that can be used, for the following reasons:

1. Heating units, in suitable form, may be distributed in an oven or furnace, attached to a tank, table or machine, so as to give a uniform distribution of heat in just the quantity desired. Once these conditions are secured, they become fixed for all time and are not subject to change or variation as with fuel-fired equipment. This condition results in a better product, increased production and increased output per unit of floor space or for each piece of apparatus.

2. By means of automatic temperature control the work will not be overheated or underheated, but maintained at the correct temperature continuously and automatically.

3. By means of electric heat, automatically controlled, tests can be made to determine the proper rate of heating, the best temperature for accomplishing the desired results and the length of time the work must be subjected to a given temperature to produce the desired results. Once these conditions are determined, the desired product can be reproduced day by day, automatically, with the same uniform results. Electric heating has made possible the duplication of laboratory experiments in shop practice.

Accurate Cost Records Aid

The greatest progress in the application of electric heat in industrial processes has been made with manufacturing plants which have accurate cost records of each phase of operation affecting the cost of the completed products. Factors affecting costs were not overlooked, and the companies were in a position to determine the value of electric heating by accurate comparison. The cost of fuel or power is only one item affecting production cost.

Every industrial-plant engineer can arrive at a correct conclusion as to the economy of any electric heat application in his plant if he will intelligently begin an investigation of the heating applications of his plant, estimate the power required for electrification and have a good working knowledge of the equipment available and how to apply it. Serious consideration must be given to all phases contributing to the production of the completed article. Among the subjects which should be investigated are the following:

Quality of Product.—High-grade quality products have a relatively high sales price. The finished product may be made up of a number of components requiring the use of heat during some stage of manufacture. Determining what these parts are and then finding out from the sales department exactly how much more it can get for the product, or how much it would increase the sales if a better product were possible, is necessary.

Uniform Products.—A uniform product is essential, whether it be uniformly good, uniformly fair or uniformly poor. If a product is excellent one day and only fair the next, it must mean one of three things:

1. If the sales department demands only a high-grade product, all productions not coming up to such specifications must be rejected. The cost of producing rejected materials must be added to the cost of producing those which meet the specifications, resulting in increased selling price or decreased profit.

2. The product is sorted into two or more grades. A lower price must necessarily be obtained for the inferior grade or grades.

3. The entire product is sold as one medium grade. With this method the manufacturer is penalized through his inability to produce all high-grade material because of the production of an excessive amount of low or second-grade material.

The reason for a non-uniform product must be determined. If this can be traced to the heating of any component of the material in any stage of its manufacture, it is necessary to find out the cause as nearly as possible. It may be any one of several things:

a. Wrong temperature for producing best results.
b. Poor temperature control due to method of heating or dependence upon human element.
c. Heating done too rapidly.
d. Material not all thoroughly heated.
e. Heat not applied uniformly.
f. Dirt collecting on the work.
g. Hot gases injurious to the work.
h. Heating continued too long.
i. Work cooling off too rapidly.
j. In order to get out the production in a given time, the heating is forced, so that the outer layers or surface is subjected to a higher temperature than the center of the material.

Production.—The items entering into production, in so far as heating is concerned, which affect the cost of the finished product are:

a. Interruption caused by failure of the heating medium, which may be due to apparatus failure and repairs or failure of the source of heat.
b. Reduced production due to difficulty in retaining skilled labor.
c. Non-uniform production due to the human element in the handling of material or operation of the heating device or apparatus.
d. Overhead charges of labor, supervision, plant equipment and floor space.
e. Number of rejected parts and number of parts to be reheated in order to pass inspection.
f. Additional labor required in other departments, caused by improper heating.

Labor.—Considerations which must be taken into account regarding labor are as follows:

a. Labor required in handling the material.
b. Labor required in operating or supervising the operation of the heating device or apparatus.
c. Saving in labor if conveyor or trucks could be used.
d. Saving in labor if the heating operation can be made automatic.
e. Effect on the labor caused by present working conditions, such as exposure to excessive heat or the breathing of gases and poisonous fumes. Will a better class of labor, more productive labor or better satisfied workmen be had if these conditions are remedied?

Fires or Explosions.—This has been the cause of much property damage and loss of life. It may be due to any one of the following:

a. Form of heating medium.
b. Kind of heating apparatus.
c. Careless workmen.
d. Nature of material heated.

Since fires and explosions do not occur every day, it will be necessary to go back over the records for a period of years to determine if any have occurred and the damage done.

The suggested items entering into the selling price

and cost of a completed product are not intended to cover all costs, but are the main ones affected by the heat treatment of the material. A thorough analysis of these will serve to establish a definite basis for the formulation of plans to improve present operation conditions and will enable the plant engineer to determine the influencing factors entering into the cost of the completed product. After the above conditions have been accurately determined, and not until then, the cost of fuel may have due consideration in the minds of plant executives.

Letters from Our Readers

Why Is Load Factor So Frequently Disregarded in Hydro-Electric Developments?

To the Editors of the ELECTRICAL WORLD:

An article and a letter appearing in the ELECTRICAL WORLD for November 8 should not go unchallenged: "Power Rates in Hydro Development," by Robert F. Ewald, and "Wanted—A Standard Method of Rating Rivers," by Clement Herschel. Both writers make quite emphatic statements as to the accuracy of solution of their respective problems, so that perhaps the undersigned may be entirely wrong in attempting to stress the importance of allowing for system and plant load factor, which both fail to do.

Regarding Mr. Ewald's article, if there is a large reservoir at the upper plant and presumably smaller reservoirs at the two lower ones, the only hypothesis upon which his theory can be said to be partly correct is that the system load at any moment in the day is equally divided between all plants. This supposition ignores any time element in the travel of water from one plant to the next.

It is desired to call attention to the fact that by this assumption advantage is not taken of the large reservoir at the upper plant. In just the same manner as loads are divided between hydro-electric and steam plants, careful study will show that there should be an irregular division of loads between hydro-electric plants when material differences occur in storage available and installed capacities at the respective sites. It is suggested that a high machine installation is warranted at the upper plant, which will carry peak loads and hence operate at low daily load factor, while the lower plants with smaller pondages must operate at correspondingly higher daily load factors while carrying the base load. Nor is this statement strictly correct because the proportionate load adjustments between plants will vary at different times in the day and for different rates of stream flow available.

The general principles of the method suggested by Mr. Herschel in his letter have been used considerably, but here again it appears that load factor should not be so emphatically set to one side. Admittedly, load factor is an uncertain element, but so is future stream flow. It would appear to be just as reasonable to make estimates of probable future load factors—i.e., guesses as to shape of load curve—on the basis of past history as to base future stream-flow estimates on the past.

The only justification for omitting load factor considerations is in the compilation of comparative statistics where it is desirable to reduce all cases to some common basis and eliminate as many of the variables as possible. This is done by the United States Geological Survey when it proposes using the power corresponding to the run-off at 90 per cent and 50 per cent of the time on the average duration curve. Perhaps even in the latter case the Geological Survey should specify some period of years as a common base, as it is obviously incorrect to compare results established on the basis of duration curves covering forty years with those covering only five years.

The writer has already discussed many phases of stream flow and power estimates in technical papers on record, notably in the *Journal* of the Boston Society of Civil Engineers in 1916 and in discussion in the American Society of Civil Engineers in 1922. In the latter discussion a method of classifying streams as to run-off has been pointed out.

The entire subject is too involved to discuss at length in a letter, but it is hoped that engineers will not accept too readily any proposed solution which does not include a study of the load-factor problem. DANA M. WOOD.

Belmont, Mass.

Developed Water Power in Great Britain More than 178,000 Hp.

To the Editors of the ELECTRICAL WORLD:

On page 843 of your issue of October 18 a correspondent, writing for the expressed purpose of correcting errors in estimating the world's water power, makes the astonishing statement that "the total developed water power in Great Britain probably does not exceed 3,000 hp."

The Census of Production of the United Kingdom, 1907, gave the capacity of water-power installations as 178,000 hp., and the water-power committee of the Conjoint Board of Scientific Societies, after long investigation, stated in its second report (March, 1919) that there was then approximately 210,000 brake-horsepower.

The hydro-electric plant of the British Aluminum Company at Kinlochleven, concerning which your correspondent says "the total capacity of which as well as I remember does not exceed 2,500 hp.," has a normal capacity of 23,100 kw. In Wales the Aluminum Corporation has a plant of 5,400 kw. in operation and another of 15,000 kw. under construction, and the North Wales Power & Traction Company has a plant of 5,500 kw. in operation and another of 12,000 kw. capacity under construction. In England there are municipal water-power plants at Chester, Salisbury and Worcester, some 16,000 hp. installed in mills in Yorkshire and other plants.

Parliamentary powers have been obtained by the British Aluminum Company to develop a further 75,000 kw. at Lochaber and by the Grampian Electricity Supply Company to develop 40,000 kw.

Prof. A. H. Gibson, who was a member of both the government and Board of Scientific Societies water-power committees, stated in a paper read at the World Power Conference that the fuel-power plants of Great Britain were equivalent to a continuous twenty-four-hour output of 4,000,000 hp. and that the water-power resources should be capable of supplying 20 per cent of this; that is, of supplying 800,000 continuous twenty-four-hour horsepower. H. E. M. KENSIT.

Ottawa, Canada.

Central Station and Industrial Practice

Unusual Conditions Cause Motors to Run Backward

By G. Cooley
Northern States Power Company, St. Paul, Minn.

A VERY unusual combination of conditions recently existed on a 4,000/2,300-volt, four-wire, three-phase distribution system which caused the motors fed from one of the transformer banks to run backward, while service at all other points on the system was normal. The neutral on this system is solidly grounded, and transformers with a ratio of ten to one are connected star-delta to give three-phase service at 230 volts. The lighting is obtained from single-phase transformers, with a ratio of twenty to ten to one, connected between one of the phase wires and the neutral.

Investigation of this bank of transformers showed the secondary voltage to be of normal value and balanced. The fuse at transformer C_1 Fig. 1 was found to be blown. This fuse was replaced and the fuse at transformer A_1 immediately blew. The motors then ran normally. The delta connection was opened, as shown in Fig. 2, and the burned-out fuse replaced. Voltage readings were taken and a diagram constructed (Fig. 2), which indicated that the voltages of two of the primary wires were equal in magnitude and direction. This, of course, indicated an open in phase *a* and a cross between *a* and *c*, since the motors ran backward when feeding from transformers A_1 and B_1.

A check of the system was made, and the cross was found at another transformer bank about a mile away. Here the *a* bus wire had fused to the transformer tap feeding from the *c* bus wire, but had burned clear on the load side so that service from

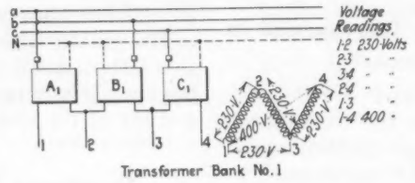


FIG. 2—ANALYSIS OF TRANSFORMER CONNECTIONS

this bank of transformers was normal—transformers B_2 and C_2 carrying the load.

The line fuse that was in phase *a* had blown and cleared the wire so that it was feeding all its connections from phase *c* through the cross at transformer bank No. 2. Owing to the combination of conditions existing on the system and the events which occurred, following the crossing of the two primary wires, service had remained normal at all points except at transformer bank No. 1. The well-grounded neutral had kept the phase distortion from becoming apparent.

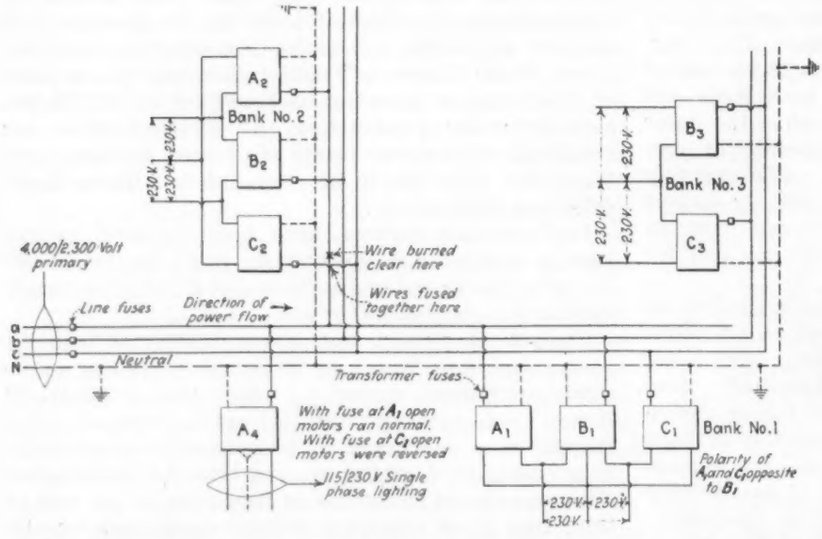


FIG. 1—CONNECTIONS OF POWER LOADS TO THREE-PHASE, FOUR-WIRE SERVICE

Cost of Aërial Cable Construction

By F. A. Westbrook
Consulting Engineer, New Canaan, Conn.

THE use of multiple-conductor high-tension aërial power cables is gradually increasing, and the growth in demand for power for both residential and industrial purposes has been so fast that the problem of transmission between generating stations and substations has become more and more difficult. Where an open-wire line formerly served the purpose it is now entirely inadequate. Such inadequacy is the result of a number of circumstances.

The most vital of these is that under the conditions usually found when open-wire high-tension lines are strung on highway pole lines in suburban districts it is rarely practicable to use a type of construction or operating voltage which permits of the transmission of any very large block of power. Municipal ordinances, right-of-way considerations and the impossibility of properly trimming shade trees are factors that strongly contribute to these difficulties. There is also the added consideration of maintaining continuity of service with open-wire lines, which becomes more and more serious as the demands for power and the dependence placed upon it increase in any given region.

Some of the power companies operating in the most important suburban districts on the Atlantic seaboard have solved this difficulty economically by the use of aërial cables. The plan has usually been to replace existing high-tension open wires with aërial cable and partly

TABLE I—COMPARATIVE COSTS OF AËRIAL CABLE AND OPEN CONSTRUCTION

One cable, 350,000-circ.mil, three-conductor, paper-insulated, lead-covered, on reconstructed (not new) 40-ft. poles; cost per mile	$25,000.00
Cost per kva. per mile	3.57
Two cables in place as above per cable per mile	18,000.00
Cost per kva. per mile	2.43
One No. 2/0 open-wire circuit on poles of proper heights, per mile	6,000.00
Cost per kva. per mile	1.50
Two No. 2/0 circuits as above	8,000.00
Cost per kva. per mile	1.00

TABLE II—ITEMS COVERING COST OF AËRIAL CABLE CONSTRUCTION

Cost of cable (same as in Table I), per foot	$1.50- $2.00
Cable ordered in 600-ft. lengths (this means nine splices per mile); cost per splice	$50.00- $75.00
Gang pulling four reels per day	75.00
Cost of pole replacements, per pole	$40.00-$100.00

reconstruct the line by guying weakened poles where this may be necessary. One of the principal reasons for strengthening such a line is not so much the weight of the cables as the stresses incurred during the operation of pulling them through the supporting rings—a process described in the ELECTRICAL WORLD of September 15, 1923.

A single-pole line can readily carry two three-conductor, 350,000-circ.mil paper-insulated cables, each of which is capable of transmitting 7,000 kva. at 13,200 volts. Higher voltages can, of course, be used, and there are numerous 25,000-volt cables now in service. An open-wire circuit (three-phase) with No. 2/0 bare wires would carry but 4,000 kva. at 13,200 volts.

One of the companies operating in the district mentioned has made a comparison in the costs of construction, these being given in Table I. Certain items entering into the cost of aërial cable construction are given in Table II.

With either type of construction given in Table I there is provision for cross-arms for low-tension distribution, but it is felt by this company that two No. 2/0 three-phase open-wire circuits are the most which should be placed on one pole line.

Transmission and Summation of Meter Readings by Use of Distant Dial

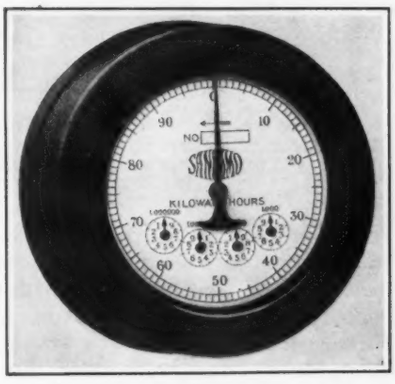
BY R. E. THATCHER
Service Superintendent Puget Sound Power & Light Company, Seattle, Wash.

IN GENERATING stations and in the general distribution of power to customers there are frequent occasions where it is desirable to have the energy generated at one location recorded at a distance from the point of generation beyond the permissible length of leads that can be employed with instrument transformers without an undue sacrifice of accuracy. In other cases conditions may require that the energy generated at several locations be summed up on one device at one location, or that energy delivered to customers at several locations in different amounts and at different times be summed up on one instrument for the purpose of reading maximum demand and kilowatt-hours.

Numerous plans have been suggested for securing these results. Many of these plans, however, have been very limited in their application owing to their high cost and the complicated arrangement of the equipment.

Within the last year the Sangamo Electric Company has announced the production of a distant dial by means of which the energy registered through a number of watt-hour meters may be totalized on one dial, which may be placed at almost any reasonable distance from the point of metering. To this distant dial may be attached the usual contacts for operating a printometer, graphometer or similar instrument for recording maximum demand. The instrument, therefore, is applicable to any of the uses previously mentioned and the cost of the equipment is comparatively low.

The distant dial contains a polarized relay which moves a hand over the dial one step for each reversal of the direct-current control circuit. A reversing switch is installed on the register of each watt-hour meter. This switch reverses the current in the relay of the distant dial once for each predetermined number of watt-hours.



PUGET SOUND COMPANY HAS FOUND DISTANT-DIAL METER TO WORK SATISFACTORILY

Since the polarized relay operates on reversal of current, it is apparent that any number of meter registers may be connected to the control circuit and, therefore, register on the distant dial. The number of meters which can be connected to one distant dial and give accurate results is limited, however, by the fact that if a contact occurs in two meters at the same instant neither registers on the distant dial. In practice, therefore, the number of meters that can be connected to one dial is limited by the degree of accuracy desired in the distant dial readings. It should be borne in mind, however, in this connection that the operation of the distant dial, even when the dial misses a contact, does not interfere with the correct registration of the meter itself.

LIMITS OF ACCURACY

Assuming that a certain error is permissible, another condition—namely, the per cent of full load that each meter carries—must be known before the number of meters that can be connected to one dial can be determined. Our experience has shown that with each meter carrying its full load continuously the energy registered by five meters may be transmitted to the distant dial with an error of approximately 1 per cent. With each meter carrying half load continuously the number of meters may be increased to eight or ten for the same degree of accuracy.

USE WITH PRINTOMETER

When a maximum-demand attachment, such as a printometer, is attached to the distant dial, a different condition is found to exist. As those who have had experience with printometers and similar devices know, a contact which represents a certain number of watt-hours may be made at the beginning of a demand interval just after the printometer has printed. Similarly, at the close of the period a contact may be made just before printing the maximum demand.

The result is that the indicated demand is above the actual demand. This error, however, is not serious with only one meter, as the number of contacts to be made by the watt-hour element is generally so chosen as to make the error from the loss or gain of one contact in the demand interval fall within the usual limits of commercial accuracy.

However, in our test with ten meters connected to one distant dial

operating at a constant load of about three-quarters the capacity of the meters and the distant dial operating the usual printometer, these contacts would actually accumulate and begin registering on the distant dial and printometer immediately after printing at the beginning of a period and then all contact again just before printing at the end of the period, thereby causing an error of between 7 and 8 per cent. When this occurred it, of course, made the printed demand for the interval preceding or following, or both, lower than they should have been. This is an extreme case as in practice the meters will seldom be evenly loaded and such a condition is not likely to be encountered.

It should be particularly pointed out that the error noted is not due to the failure of the distant dial to function, nor to the printometer, but is inherent in the scheme.

It was noted above that when contacts in the watt-hour meter dials occurred at the same instant the energy represented was not registered on the distant dial. In a test on ranges covering a period of three weeks the incorrect registration from this source was only 0.6 per cent. This would, of course, be increased somewhat if the load on the meters was of longer duration.

APPLIED TO RANGE TESTING

In an installation made to study the demand of ten electric ranges in a part of Seattle's most prominent residential district the control circuit was over a mile long and very satisfactory operation was obtained on 27 volts. As a result of this installation electric range manufacturers have become vitally interested and are helping to finance further studies to obtain detailed information on the diversity factor of the electric range load.

By proper arrangement of dials it is possible to add the energy measured by direct-current and alternating-current meters, and the meters need not be of the same size. A distant dial is now being developed for use with alternating-current control circuits, thus eliminating the need for the direct-current control circuit previously required when the distant dial was used with alternating-current meters.

The equipment outlined will furnish at reasonable cost a service which heretofore has been impossible to obtain without a very great expense.

Reconstruction of Boiler Furnace Walls

COMPLETE side-wall and front-wall patches, using crushed linings from old furnaces as a refractory base, are being successfully used on oil-burning boiler furnaces at the Glenwood power station of the New York Central Railroad Company. This method of construction was tried out by the plant superintendent, and a recent inspection of one of the walls so repaired shows it to be in excellent condition after eight months' service.

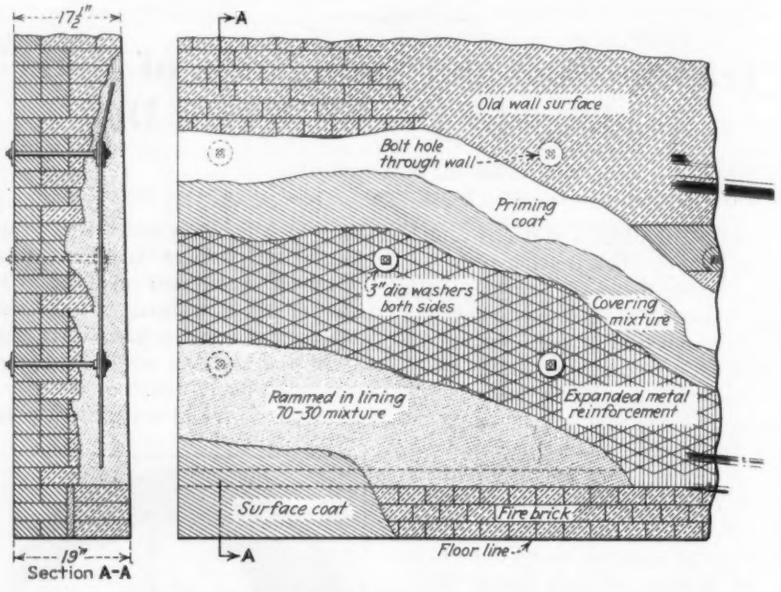
For the side-wall patches expanded metal reinforcement is embedded in the patch and anchored through the wall, using ⅝-in. bolts placed at suitable intervals. The service required is unusually severe, not only on account of the use of oil fuel, but because of the fact that this station is used to carry peak loads morning and afternoon, with a consequent cooling and heating of furnace walls twice in each twenty-four hours. The work done illustrates admirably how much old material can be picked up around the plant and put into service.

The expanded metal used happened to be some left-over material such as is used for reinforcing concrete floors and roads. All of the materials for patching work of this sort are, as a rule, available around any boiler plant, with the possible exception of the expanded metal. The metal used for this work is soft open-hearth steel, which can be obtained in standard sizes, 5 ft. 3 in. wide in 8-ft. or 10-ft. lengths, at a cost of approximately $6.50 per 100 sq.ft.

Bolts and washers of suitable size were found around the plant, and the refractory material used was firebrick which had already seen much service at high temperature in the same furnaces. This was crushed to ½-in. mesh, using the "fines," and mixed with "Hytempite" in the proportion of 70 lb. of crushed brick to 30 lb. of "Hytempite." In making the mixture the "Hytempite" was first diluted to a heavy pancake batter and the crushed material gradually added and thoroughly mixed.

One of the walls repaired, as shown in the accompanying diagram, was eaten away to the full depth of the firebrick lining, so that the red brick was exposed. In preparing the wall all loose material was removed, leaving as far as possible the firebrick header projecting into the space to be patched. The metal reinforcement was then placed and bolts were attached, holes through the wall being easily made with an air hammer. Three courses of firebrick were laid at the floor line, giving the wall a thickness of 19 in. at that point, so as to permit the patch to slope back slightly—about ½ in. to each foot in height. This was done to prevent bulging of the wall.

A wood form was then erected in sections and the old firebrick mixture was rammed in behind the form after the old wall surface had been prepared with a priming coat of



METHOD OF REPAIRING OR RECONSTRUCTING BOILER-FURNACE WALLS, USING OLD MATERIAL FOUND AROUND THE PLANT

"Hytempite" followed by a coat of the mixture. This latter coat was applied sectionally as the ramming-in progressed, so as to insure a moist surface that would bond the crushed firebrick mixture to the old wall.

The whole job was completed within two days. This method of reconstruction prevented the tearing out of entire side walls, and it continues to give excellent results in service.

Systematic Inspection of Pole Lines

Cause of Decay in Wooden Poles—General Plan of Inspection—Directions for Conducting Work and Records that Should Be Kept

THAT systematic inspection of pole lines is essential if a safe and reliable distribution system is expected was one of the points brought out by L. I. Bates, engineer of electric distribution of the Bronx Gas & Electric Company, in a paper presented at the Empire State Gas & Electric Association convention held at Syracuse, N. Y., December 4 and 5. A line may be correctly designed and properly built of the best materials, Mr. Bates said, and yet will be unreliable and unsafe unless inspected periodically so that defects may be corrected before they become serious.

The decay of wood is generally due to the activities of certain low forms of plant life known as fungi, punk, toadstools, etc. Bacteria are also known to cause decay, but their action is not well understood, and in order to illustrate the manner in which these organisms promote decay a description of the fungi will suffice.

These plants have their origin in minute spores, borne from place to place by the wind. Those that lodge and find a suitable situation for growth, which may be on living or dead timber, germinate, provided the conditions are favorable, and at once attack the wood. The plants grow with great rapidity, sending out numerous threads which penetrate the wood and attack the contents of the wood cells and finally the cell walls, the result being the reduction of the wood into a mass having little or no resemblance to the original material.

The most favorable conditions for the growth of fungi and other organisms of decay are an abundant food supply, heat, moisture and air, the amount of each required being dependent upon the kind of organism. A certain amount of moisture must be present or decay cannot set in. Air is also essential, and thus may be explained the lasting qualities of wood when kept perfectly dry and the perfect state of preservation if wood which has been under water for long periods, moisture being lacking in the first case and air in the second. A familiar example, serving well to illustrate the foregoing, is the rotting of fence posts and poles in the zone extending from just below to just above the ground line. At the base of the pole, while moisture is present, air is excluded, while above the ground the pole is generally dry. It is where moisture and air are both present, the former being drawn by capillary attraction from the ground, that decay begins.

General Plan of Inspection

Since the decay of timber is due to the attacks of wood-destroying fungi, and since the most important condition of growth of these fungi is water, anything which increases the time during which moisture will remain in contact with the timber will decrease the life of the timber. Poles set in moist ground or ground where heavy grass which forms a protection for the ground grows will bear more careful inspection as the chances for decay are greater under these conditions.

The decay of poles before their installation in the line may be of several kinds, and together with the several kinds of cracks or other injuries constitute what are known as defects. The former include butt rot, heart rot, ring rot and rotten knots, and the latter seasoning checks, "wind shakes" or "ring shakes," "cat faces" and loose knots. Any poles showing evidences of any defects should be examined to see that the defect has not spread and weakened the pole. Some detailed instructions to inspectors would seem very desirable since exactly the same defects may have an entirely different significance in two locations on the pole. Thus a rotten heart, very common in cedar, may be in the center of the cross-section, and therefore of the least effect, or it may be well toward one side. A wooden pole is not greatly affected by hollowing out a small portion at the center of the cross-section, but the strength is decreased by any loss of area near the circumference or any reduction of diameter. The importance of the above is shown by the following: A pole which has 35 per cent of its center rotted away but the remaining outer wood in perfect condition is weakened by about 1 per cent; if this same rot is considerably off center the pole may be weakened as much as 10 per cent to 15 per cent, while a 20 per cent decrease in the diameter of the pole due to rot at its circumference would decrease the strength of the pole around 50 per cent.

It is important that a reliable man be chosen for this work since the judgment of the inspector is relied upon to a great extent. As the average life of a pole is between ten and fifteen years, it is not necessary to spend much time on pole inspections for the first five years, but the general conditions of the line should be inspected in order to see that it has developed no weak spots due to service attachment strains and mechanical damage. As the winter months are the hardest on the lines, the fall is the best time to make the general inspection, and the entire system should be inspected at least once a year.

Directions for Inspection

The inspector should be provided with a field book in which to enter the result of his findings and should enter the street, pole number and the nature of the defect, along with a description, defects being classified as follows: "A+" is given to defects which should have immediate attention; "A" is given to defects which should have attention before the severe weather sets in; "B" is given to defects which should bear watching, and if any changes or additions are contemplated to the pole in question the defects should have consideration before the changes or additional load is placed on it; "C" is given to defects which are not serious at the present time but which will bear watching in a year or two.

Examination of the pole at the ground line should consist of testing the base of the pole with a testing bar. If any sign of decay exists at this point, the pole should be tested around its entire circumference, as frequently a pole will decay in one or more places much faster than at other points. The greatest decay will probably occur from 2 in. to 6 in. below the ground line. If a sidewalk

interferes with the proper inspection of a pole which shows signs of decay, the walk should be broken away to allow proper inspection, but should be reported in order that proper repairs may be made later.

Where there is evidence of hollow rot or attack by termites, the pole should be sounded carefully on all sides for a distance of 6 ft. above the ground. If it shows signs of being hollow, borings should be made to determine whether there is sufficient solid material to support the load on the pole. The pole should then be examined for other defects, such as cracks, splits, large holes, leaning, etc. The load on the pole should be considered and an estimate of the probable life of the pole made and then entered under its proper class heading.

In addition to the pole inspection, the general condition of the line, with attention to such conditions as excessive sag and tight or loose service wires (owing to poles leaning), also the condition of service attachments, insulators, pins, guys, etc., should be noted and entered in the record where the conditions warrant.

RECORD OF INSPECTIONS

From the field record the working record is then made up, the A+ class receiving immediate attention. The three other classes are then arranged according to districts and streets, in accordance with the way the records are kept, and the class A defects are cleared up as soon as convenient. The class B defects are watched and are cleared or left, according to conditions.

In the next inspection period the class B defects which have not been corrected and the class C defects are reported to the inspector, and he gives them special attention and enters them on the current year's inspection record under the proper class, according to their present conditions. This inspection record should be kept separate from and in addition to the regular pole record, which contains all pertinent data regarding the pole. The regular pole record is primarily a pole-location record, and if used for the inspection record will be crowded with information which is of no value after that individual pole is discarded. Moreover, because of the limited space available, data which should be recorded might be left off when entries were being made.

By following up these inspection records carefully, provided that the inspector is capable and conscientious, a definite report of the condition of the poles and lines is available, and the number of accidents and emergency repair jobs may be kept to a minimum.

Burners for "Premixed" Gas Favored

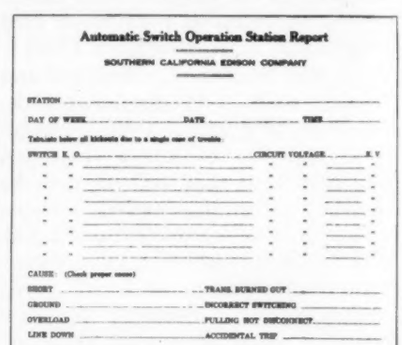
BY M. L. WRIGHT
Chief Engineer of Power Plant Southwestern Gas & Electric Company, Shreveport, La.

FLEXIBILITY of operation, increased boiler-room economy and higher furnace ratings have been obtained since burners for "premixed" gas have been installed under the boiler furnaces in the plants of this company. These burners consist essentially of a motor-driven blower with a shutter on the air inlet side for regulating the air admission and a central or axial gas feed. Several arrangements of feed are employed. On some of the boilers having eight burners the alternate ones are tapped from separate headers fed by independent blowers or gas mixers. This arrangement affords reliability of service and flexibility of operation, since if one blower becomes inoperative, the burners still furnished by the operative blower provide fairly well-distributed flames. Furthermore, the rating of the furnaces can be cut down from maximum, when both blowers and all burners are operating full capacity, by reducing the duties on both blowers simultaneously until their joint output is about comparable to that of one blower, when alternate burners can be shut off and the remainder furnished by one blower. For greater flexibility of operation than that afforded by the arrangement mentioned it would be possible to cross-connect the headers leading to the blowers and insert valves. No back fires are experienced unless the blowers are allowed to operate at too low a rating as occurs during low loads or in starting. Even in such cases the explosion caused by the back fire is not serious.

In practice it is possible to obtain the most economical mixture of gas and air by observing the appearance of the flame in the furnace. When the mixture is too rich in gas, the flame will not be uniform in density and the opposite wall of the furnace cannot be clearly seen. It is therefore the practice to adjust the burners so that they will just smoke slightly and cloud the flame and then to increase the air supply until the cloud disappears.

Relay Operation Checked by Station Reports

IT HAS been found by the Southern California Edison Company that a thorough study of relay operations results in more confidence in these pieces of apparatus and in the clearing up of many conditions responsible for interruption of service. For compiling data on the operation of relays the form shown in the accompanying illustration is used by this company. The report is made out in duplicate by the operator at each station whenever an automatic switch kicks out. The original is mailed at once to the superintendent of substation operation or to the superintendent of generation, who immediately forwards it to the protection engineer.



Automatic Switch Operation Station Report

SOUTHERN CALIFORNIA EDISON COMPANY

STATION _____

DAY OF WEEK _____ DATE _____ TIME _____

Tabulate below all kickouts due to a single case of trouble.

SWITCH K. O. _____ CIRCUIT VOLTAGE _____ K. V.

"	"			"	"
"	"			"	"
"	"			"	"
"	"			"	"
"	"			"	"
"	"			"	"
"	"			"	"
"	"			"	"

CAUSE: (Check proper cause)

SHORT _____ TRANS. BURNED OUT _____

GROUND _____ INCORRECT SWITCHING _____

OVERLOAD _____ PULLING HOT DISCONNECT _____

LINE DOWN _____ ACCIDENTAL TRIP _____

TROUBLE IN _____ District

LOCATION OF TROUBLE _____

DETAILS: _____

Signed: _____ Operator

Checked: _____ Station Chief

REPORT FOR CHECKING OPERATION OF AUTOMATIC OIL CIRCUIT BREAKERS

The duplicate becomes a part of the permanent substation file.

As will be seen, the report gives the name of the station, date and time of trouble, name of switch and circuit voltage, kind of trouble, its location, and any details which are available before the report is mailed. On the back of the sheet the operator draws a simple single-line diagram of the station, showing how it was operating at the time of trouble and indicating the position of the switches.

Such reports have been found of great value to the protection engineer in analyzing the trouble. All automatic switch operations are tabulated on an analysis sheet, which indicates the cause of the trouble and whether the operation was correct, incorrect or questionable. A summary is compiled from these sheets each month, and from this summary the performance of the relays can be determined.

Central Station Business

Radio Increases Use of Energy 40 per Cent

TO OBTAIN some indication of the increase in energy consumption caused by the use of radio receiving sets by residential customers, the Central Hudson Gas & Electric Company of Poughkeepsie, N. Y., recently conducted an investigation among a group of domestic users in its several districts.

Results as obtained are necessarily only an indication and should not be taken as the positive determination of the amount of actual increase in load in a whole district or on the company's entire system. The data collected, however, verify the general impression that radio has had a very noticeable effect toward increasing the use of light by residential customers. As shown in Table II, which is a recapitulation of the six districts investigated, an increase of about 40 per cent has been realized among the fifty customers selected for study.

Table I gives the summary for the Rhinebeck district, which shows the highest total average increase of the six districts studied. Table III shows how a comparison of the monthly electric bills of an individual customer was made.

The increase in energy consumption is attributed to two distinct causes, battery charging and additional use of lights, each occasioned by the use of radio.

In each district served by the company a group of customers were selected who had installed radio and operated it for a period of from five to twenty-two months. Their monthly kilowatt-hour consumption since such installation and the consumption for the corresponding months of the previous year were tabulated. These were extended to include the increase in consumption and the percentage increase. Following the individual results a table of district values was made up to include the several customers, their results and the percentage increase for the district. Finally the totals and percentages of each district were assembled into a grand total and the over-all increase in percentage was ascertained, as shown in Table II.

It must be noted, of course, that the increase as tabulated for each district is but an indication and should not be applied as the total increase for such districts. To ascertain this would require a detailed study of every radio user in the several communities, where the number of radio enthusiasts changes daily. The investigation does show, however, that where a customer operates a radio receiving set he will almost certainly increase his use of light by from 10 to 40 per cent.

TABLE I—ENERGY CONSUMED BY CUSTOMERS USING RADIO SETS

Consumer	Record, Months	Kw.-Hr. Previous	Kw.-Hr. Recent	Kw.-Hr. Increase	Per Cent Increase
A	6	105	308	203	193
B	8	215	276	61	28
C	6	69	101	32	46
D	9	131	299	168	128
E	6	86	176	90	105
F	16	263	433	170	65
G	6	43	69	26	61
H	12	131	252	121	92
I	8	548	679	131	24
J	8	735	1,215	480	65
Total	85	2,326	3,808	1,482	
Avg. per month		27.36	44.8	17.42	63.71

TABLE III—COMPARISON OF ELECTRIC BILLS OF ONE CONSUMER BEFORE AND AFTER INSTALLING A RADIO SET

Month	Kw.-Hr. 1922	Kw.-Hr. 1923	Kw.-Hr. Increase	Per Cent Increase
May	10	16	6	60.0
June	6	12	6	50.0
July	7	10	3	42.8
August	7	12	5	71.4
September	10	7	—3	—30.0
October	12	22	10	83.3
November	15	19	4	26.7
December	17	19	2	11.8
	1923	1924		
January	15	23	8	53.3
February	8	19	11	137.5
March	15	21	6	40.0
April	18	19	1	5.6
	140	199	59	42.0

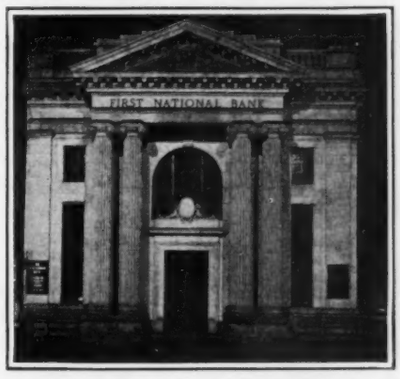
TABLE II—ANALYSIS OF ENERGY CONSUMPTION BY CONSUMERS WITH RADIO SETS

District	No. of Consumers	Total Month of Record	Kw.-Hr. Consumption: Previous to Radio Installation Total	Previous to Radio Installation Avg.	After Installation Total	After Installation Avg.	Increase After Installation, Total	Increase After Installation, Avg.	Per Cent Increase
Rhinebeck	10	85	2,326	27.36	3,808	44.80	1,482	17.42	63.71
Kingston	10	84	2,592	30.86	3,641	43.36	1,049	12.49	40.50
Newburgh	6	94	2,853	30.30	3,872	41.20	1,019	10.90	36.00
Beacon	5	59	2,268	38.50	3,032	51.50	764	13.00	33.70
Poughkeepsie	10	80	3,424	42.80	4,537	56.71	1,113	13.91	32.51
Catskill	9	93	2,040	21.90	2,747	29.50	707	7.60	32.30
Total	50	495	15,503	31.35	21,637	43.70	6,134	12.40	39.55

Striking Floodlighting Effect at Small Cost

FLOODLIGHTING of buildings offers central-station companies a profitable means of increasing their lighting load, and frequently striking results can be obtained at a comparatively small cost. The accompanying night view of a bank building in Hoboken, N. J., recently floodlighted by the Public Service Gas & Electric Company is a typical example of an inexpensive but effective installation.

In this case the white surface of the face of the building, with a front area of 2,000 sq.ft., lent itself to direct illumination from across the street. Two wide-angle projectors, each equipped with a 1,000-watt lamp, were installed at a distance of 60 ft. The cost for this equipment and its installation, including wiring, was as follows:



EFFECTIVE FLOODLIGHTING WITH TWO 1,000-WATT PROJECTORS

Two Westinghouse wide-angle projectors, at $38	$76.00
Two 1,000-watt lamps, at $4	8.00
Wiring and installation	40.00
Total cost	$124.00

The building is floodlighted an average of five hours per night the year round, and the annual consumption of energy for this purpose is between 3,500 kw.-hr. and 4,000 kw.-hr.

Electric Refrigeration in Chicago

Commonwealth Edison Has Organized Separate Department to Promote Business—Sales Have Exceeded Expectations —Large Increase Expected in 1925

BY OLIVER R. HOGUE
Head Lighting Agent Commonwealth Edison Company

IN HOUSEHOLD electric refrigerators the Commonwealth Edison Company has for a number of years seen an appliance which, properly developed, would greatly enhance the value of electric service to its domestic users and at the same time return to the company a handsome increase in revenue from the residential customer. Like many other electric utilities, this company has made a careful study of electric refrigerating machines to determine if they have reached a point of mechanical development that will make it practicable for the company to promote their sale on a commercial scale.

Two years ago we adopted a standard electric refrigerator, and we have been handling this machine since that time. During the year 1923 progress was very slow. But in the early part of 1924 we organized a separate department with a corps of five salesmen to promote and sell this machine. Our business this year has been very satisfactory —in fact, more than we anticipated. We filled two large orders, one of thirty machines and the other of seventy machines. We are now figuring on several other large orders, one of which will require four hundred machines. Up to November 1 a total of 279 machines had been sold. Individual sales have shown a marked increase because of our canvassing and advertising, which has been carried on consistently, and we look for a very successful year in 1925.

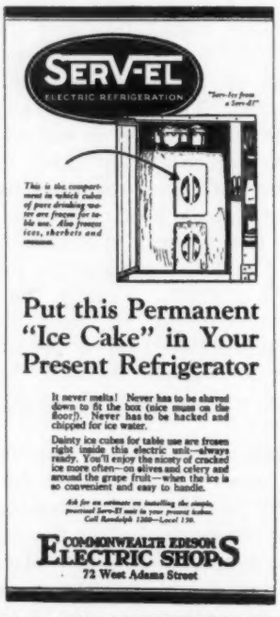
CONTINUOUS SERVICE ESSENTIAL

In building a foundation for a continuous and stable business it is necessary for the central-station company to consider the perfect performance of the machine not only during its first year's operation but for from five to ten years in the future.

I do not believe that we should sell electric refrigeration, but a company should sell the customers a continuous service, and the original price should include at least one year's service. A careful study and analysis should be made of the cost of service calls on existing installations so that a reasonable figure can be set up as a servicing charge on the machine from year to year.

To educate the public to take care of minor details in the operation of so comparatively simple a piece of machinery as the electric refrigerator will take a good many years. It is necessary to oil the motor occasionally, and it is also necessary to defrost the coil. During this educational pioneering process it will be necessary to publish information from time to time on the value of this method of refrigeration and its advantages.

In studying the performances of the better grade of electric refrigerators on the market—and there are several—we have found that most of the machines are equipped with motors of sufficient capacity. They are of fairly rugged construc-


SERV-EL
ELECTRIC REFRIGERATION
Put this Permanent "Ice Cake" in Your Present Refrigerator
It never melts! Never has to be shaved down to fit the box (nice mess on the floor!). Never has to be hacked and chipped for ice water.
Dainty ice cubes for table use are frozen right inside this electric unit—always ready. You'll enjoy the society of cracked ice more often—on olives and celery and around the grape fruit—when the ice is so convenient and easy to handle.
COMMONWEALTH EDISON
ELECTRIC SHOPS
72 West Adams Street

REFRIGERATOR ADVERTISING USED BY COMMONWEALTH EDISON

tion. The number and cost of service calls is not excessively high, but these will be materially reduced by further improvements in design and construction which are bound to come and by an educational campaign conducted by service men so that a customer will be able at least to make minor adjustments, oil and defrost the machine.

From our experience and observation we have found that the domestic refrigerator load is very satisfactory. The energy consumption will average from 500 kw.-hr. to 700 kw.-hr. per year. The income at the rate of 5 cents per kilowatt-hour will be in the neighborhood of $30 per year. The largest motor used on this class of machine is ¼ hp., and for this demand, requiring no additional investment, the income is far in excess of that from other household electrical appliances and affords a very attractive load.

ADVANTAGEOUS SELLING FEATURES

From a selling standpoint the electric refrigerator has many excellent "talking points" for the salesman, with which he can tie up advertising copy. It offers perfect refrigeration, has positive automatic control, is clean, and has many advantages, including cube table ice. It is adaptable to making fancy puddings, ices and so forth and is constructed for storing large quantities of food. To confirm these features, the following is quoted from a signed letter received from the American Association of Medical Milk Commissions: "Eight hundred doctors and their friends were served with between fifteen and twenty cases of milk each day during the recent conference held at the Chicago Municipal Pier. This milk was cooled in an electric refrigerator. The doors of the refrigerator were opened continuously, and at no time was the temperature of the box above 55 deg. F. and never below 48 deg. F., which was the most desired temperature for our certified milk. We believe this is a most severe test for any machine and have no hesitancy in recommending this type as an ideal refrigerator."

Looking to the future of the household electric refrigerator, it seems as certain as anything can be that its use will increase year after year, and it is only a question of time until the manufacturers will be in a position where they will receive such a quantity of orders that by quantity production they will be able to produce machines to sell at a price within reach of all. Up to the present progress has been slow for the same reason as in any other line which has had to pass through a tedious development stage costing millions of dollars. We are now reaching a commercial stage where the electric refrigerator business will, it is hoped, be manufactured on a large scale, as is, for instance, the Ford automobile.

CONSPICUOUSLY SITUATED CENTRAL-STATION SALESROOM

Advantages of Prominent Store Location

LOCATION of the Kansas Electric Power Company's salesroom and office on one of the most prominent street corners of Emporia indicates that the favorable business site is just as important in the central-station business as in any other. Ralph Smalley, district manager of the company at Emporia, recently moved the company's offices from an inconspicuous street to a new location which he considers has many advantages. "In the first place," according to Mr. Smalley, "every business house congratulates itself upon a corner entrance. We now have a double amount of plate glass fronting on two streets. We are on the new Santa Fé trail, in the line of travel of most tourists. Directly opposite is our largest hotel.

"When we considered this location we had in mind the fact that within three doors housewives can pay their gas, telephone and electric bills on the first of the month. The post office is on the same street; the principal newspaper is only four doors away.

"Another factor was that a big majority of senior and junior high school students pass our salesroom on their way to and from school. Perhaps their buying power is not so great now, but I'm disposed to think that if a girl becomes obsessed with a desire for a piano lamp, or a boy wants one of our radio sets, the parents may find occasion to come in around Christmas time. And, anyway, these boys and girls are going to grow up some day and furnish homes of their own. It pays to be constantly before their eyes and in their minds.

"During the first month in the new location the company did more than twice the volume of business of any previous month. It was necessary to increase its merchandise stock very materially to meet the demands from customers.

"In the former location we had no occasion to carry a big stock because we couldn't display it. Take the one item, floor or bridge lamps. These must be displayed in the proper space and setting to look their best. Our radio needs the larger room to enable those who wish to listen in to do so without disturbing the employees in other parts of the offices.

"While the merchants of Emporia usually pay their bills by check, through the mail, at least 60 per cent of our monthly residential statements are paid in person. Women just naturally like to come down town. We are just one block from the very center of the business section and our new location has proved a very good investment."

Campaign Sells 1,110 Electric Ranges

IN THE second electric range campaign put on by the Puget Sound Power & Light Company this year 1,110 electric ranges were sold. During the first campaign, put on last spring, 803 ranges were sold. The company sells electric ranges continuously throughout the year, but during each spring and fall a special offer, including long-time payments, is made and a vigorous advertising program carried out.

The Puget Sound company hopes by the end of the year to have sold 3,000 ranges, which, on the basis of $60 annual revenue per range, will add $180,000 to the company's gross yearly income.

Utility Stock Suggested as Christmas Gift

IN A FINAL drive to close the sale of 50,000 shares of its 7 per cent cumulative preferred stock the Public Service Corporation of New Jersey is using the very appropriate poster shown here and suggesting the stock as a suitable Christmas gift. Beginning on October 1, the corporation offered to the customers of its subsidiary companies $5,000,000 par value of this stock. Employees acting as stock salesmen during their spare time and receiving a commission of $1.50 per share had by the second week in December sold more than 40,000 shares.

The stock is sold at par and accrued dividends for cash or on terms of $5 down and $5 per month per share until paid for. The amount of the accrued dividend will be included in the final installment, and interest at the rate of 6 per cent per year will be paid on all installments at the time the stock is delivered. By this means each subscriber earns dividends at the rate of 6 per cent on installment payments during the time the stock is being paid for. After the final payment the 7 per cent dividend rate begins to apply.

POSTER SUGGESTING UTILITY'S STOCK AS APPROPRIATE CHRISTMAS GIFT

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Humberarm Hydro-Electric Development in Newfoundland.—A hydro-electric development involving a proposed installed capacity of 98,000 hp. at an effective head of 250 ft. is being made on the Humber River by the Newfoundland Power & Paper Company. The flow comes from a catchment area of about 1,650 square miles and averages 5,000 cu.ft. per second throughout the year. A hollow reinforced-concrete dam, 1,000 ft. long and 75 ft. high, impounding 30,000,000,000 cu.ft., will insure continuity of power. Each of the seven units in the power house will consist of a horizontal-shaft Francis turbine and a 10,250-kva., three-phase, 50-cycle, 6,000-volt generator with direct-connected exciter, power being transmitted at 66,000 volts to the paper mill 32 miles distant, where it is to be used not only for driving the entire mechanical equipment but also for producing part of the steam required for heat processes. The article, which is illustrated, also gives data on the synchronous and induction motor equipment and electric steam boiler of 120,000 tons annual output installed at the mill. — *Engineering (England)*, Nov. 7, 1924.

Hazards of Pulverized-Fuel Systems.—H. E. NEWELL and ROBERT PALM.—The trend in the direction of the use of pulverized fuels for power-generating purposes has been so pronounced that underwriting and fire-protection agencies have deemed essential the preparation of suitable installation requirements. Features that will minimize the hazard of spontaneous ignition of dust are set forth by the author, under the heads of segregation, construction, ventilation, magnetic separators, location and arrangement of driers, delivery to points of consumption, electrical equipment and housekeeping. Types of systems are classified and safety requirements are discussed. — *Mechanical Engineering*, Mid-November, 1924.

Generation, Control, Switching and Protection

Polyphase High-Frequency Alternators.—SHIGETARO CHIBA.—The practical usefulness of the polyphase high-frequency alternators is pointed out. If each phase of a three-phase machine is connected to one of a group of antennas spaced one third of a wavelength apart, the radiation will be directional. The conditions for maximum output per unit length of stator are investigated mathematically.—*Journal of the Institution of Electrical Engineers (England)*, November, 1924.

Protective Relays—I.—H. E. FREY.—To restrict faults in an extended electric network to the smallest possible area various kinds of relays are required, which have to respond accurately to their particular duty. The present serial paper describes the latest models of these apparatus. In the first installment are shown a time-depending maximum-current relay of the Ferrais type, a weight lifted representing the time factor; an independent maximum-current relay, suitable for direct mounting upon oil switches, and finally a reverse-watt relay, also of the Ferrais type.—*Brown-Boveri Mitteilungen*, November, 1924.

Interchange of Power in the Southeastern States. — J. M. OLIVER. — The author shows how interconnection of seven independent companies, operating in a territory 600 miles long and 300 miles wide at its broadest part and having an aggregate generating capacity in steam and hydro-electric plants in excess of 800,000 kw., has made it possible to attain higher efficiencies, economize in the use of water, and increase the reliability of service. Specific instances of the relaying of power and the meeting of emergency conditions are described, with illustrative load curves of the Alabama Power Company's system. — *Iron and Steel Engineer*, November, 1924.

Effect of Frequency Changes of Electric Machines and Apparatus. — H. MARUYAMA and S. MOMOTA.—Japan is confronted with the problem of unifying frequencies as both 50 cycles and 60 cycles are being developed at an almost equal rate. For the purpose of unification a committee has been formed to study how the characteristics of machines will change by changes of cycles and how they can be remodeled so as to suit the change frequency. The author in this article considers alternators, induction motors and transformers.—*Journal of the Institute of Electrical Engineers of Japan*, No. 435.

Transmission, Substations and Distribution

Power-Transmission Lines.—W. T. TAYLOR.—This is Part V of a six-part article dealing with the aspects of transmission-line design. This section deals particularly with factors of safety and the choice of line supports and their sizes and includes a chart for finding the size of line supports.—*Electrical Review (England)*, Oct. 31 and Nov. 7, 1924.

Current-Carrying Capacity of Solid Bare Copper and Aluminum Conductors.—S. W. MELSON and H. C. BOOTH.—The dissipation of heat from a conductor is a function of the temperature elevation above the surrounding air, the size and shape of the conductor and the intrinsic condition of its surface. A cooling-curve method is described which was used in determining the coefficient of heat emissivity for a series of small sample lengths of round and flat copper and aluminum conductors of various sizes and surface conditions. This was checked by the direct electrical heating of longer pieces. Tables for the current-carrying capacity of busbars corresponding to 30 deg. C. rise above a surrounding air temperature of 40 deg. C. have been deduced from the constants obtained and are given in the paper.—*Journal of the Institution of Electrical Engineers (England)*, November, 1924.

Grounding of Long-Distance Transmission Line with Petersen Coils.—T. OHTSUKI.—The author presents general equations for a transmission line grounded through resistance at any point on the line for any treatment of the neutral points of the system with consideration of all line constants. Thus the accurate compensating value of the earth coil is derived and the number and situation of coils on the system are determined. A theoretical investigation of the problem is given. —*Journal of the Institute of Electrical Engineers of Japan*, No. 434.

Units, Measurements and Instruments

Determination of the "Extinction" Voltages for Low-Tension Discharge Tubes. — J. TAYLOR and W. STEPHENSON.—The authors deal with a ballistic galvanometer null method for the determination of the "extinction" or "lower critical" voltages for low-tension discharge tubes under different conditions of discharge. By this method the variations of the lower critical voltage with the amount of energy thrown through the tube from a condenser shunted across its electrodes may be investigated.—*Journal of Scientific Instruments (England)*, November, 1924.

Null Method for Testing Magnetic Properties of Materials.—Y. NIWA.—The theory, construction and operation of the permeameter devised by the author is discussed. This apparatus consists of a double bar and double yoke. The reluctance of the yoke and gaps are compensated by the magnetizing coils, which are excited and regulated independently. Experiments show that the permeameter gives satisfactory results in the measurement of magnetic properties of solid and sheet materials of iron and steel. Its accuracy is also said to be very good.—*Journal of the Institute of Electrical Engineers of Japan*, No. 435.

Illumination

Fire Protection Apparatus in Theater.—D. BERLIT. — The stage room of a large German theater was totally destroyed by fire, and in the reconstruction of it a number of novel electric protective apparatus were installed which are described in this article. More than three hundred automatic fire signaling relays are distributed in the building. The various types of relays are described. Electrically operated valves control a water-spray arrangement of the two main fire curtains. All safety devices are operated from two separate storage batteries. A seven-circuit emergency illumination, fed from two other batteries, is distributed over the house.—*Siemens Zeitschrift*, October, 1924.

Illumination of Railroad Shops and Roundhouses. — A four-page extract from the report made to the Association of Railway Electrical Engineers, Chicago, by its committee on illumina-

tion. It includes recommendations on standard practice to meet the requirements of safety and efficiency. Consideration is given to the selection of lamps and reflectors and the best equipment for the various buildings ecountered in railway service. — *Railway Review*, Dec. 6, 1924.

Studies in the Projection of Light.— FRANK BENFORD.—In this installment (Part XIV of the series) the author discusses analytically the influence of manufacturing errors on the projection of light from a paraboloidal "second-surface" mirror.—*General Electric Review*, November, 1924.

Motors and Control

Electric Drive of Rolling Mill.—A. HARTMANN.—The author describes an up-to-date electric drive for a very heavy-duty reversing blooming roll. The main-mill motor is a direct-current twin motor of 13,200 kw. maximum output and a peak torque of 250 meter-tons. Its speed can be economically regulated between zero and plus or minus 60 r.p.m. The starting and regulating set for this motor comprises one three-phase induction motor of 2,100 kw. continuous rating, connected with two direct-current generators and one 30-ton flywheel, all on one shaft, running at 750 r.p.m. top speed. This group derives its excitation from a separate small motor-generator set, provided in duplicate. The main motor is forced-air-cooled and weighs complete 180 tons. The regulation of rolling speed is accomplished by supplying direct current of from 60 volts to 150 volts to the main motor, using the Leonard method. The motor can be reversed twenty times a minute. The article goes into considerable detail describing the various elements of the control apparatus, and gives finally a number of rolling diagrams, in which output, speed, current and voltage are recorded for a given profile that it is desired to roll.—*Brown-Boveri Mitteilungen*, November, 1924.

Motor-Driven Irrigation Pumping Plants and the Electrical District.— G. E. P. SMITH.—Pumping for irrigation has attained considerable importance in Arizona. The transmission and distribution of electric power for pumping requires a large initial investment, and it becomes necessary for the landowners to form some sort of effective organization in order to finance, construct and operate transmission systems. Electric districts have been formed the function of which is to bring electric power to poles close by each farmer's pumping plant. The farmer must supply the electric motor, and usually he must supply the transformers, switches and other accessory equipment. The primary purpose of this bulletin, consisting of seventy-six pages, is to supply information both for those who desire to change their pumping plants from engines to motors and for those who desire to install new motors in pumping plants. General discussions of wells and pumps are included, and an explanation of the legal character, function and operation of electric districts is made. — *Bulletin No. 92, Experiment Station, University of Arizona.*

Heat Applications and Material Handling

Electric Drive for Clamshell-Bucket Hoists. — F. ROTHE. — Modern hoists with this type of bucket use, as a rule, the two-rope principle—that is, one rope for raising and lowering and the other rope for the closing motion of the bucket halves. The author describes various methods to provide these two motions from two cable drums driven by one or by two motors. Connection diagrams and motion charts explain the operation. Complete freedom of the two motions can only be obtained with a two-motor drive so arranged that a magnetically operated coupling permits the connection of the two motors together for the lifting of the load. The paper considers three-phase operation only. — *Siemens Zeitschrift*, September, 1924.

Methods of Hoisting Ore from Deep Levels.—J. A. VAUGHAN.—This is an excellent paper of thirty-three pages, with several inserted drawings, describing the hoisting equipment in fifteen ore mines where the ore is raised 4,000 ft. or more. These mines are in Africa. The author points out that the cost of winding in the mines is now about 20 cents per ton mined from a mean depth of about 3,000 ft. The treatise covers shafts, skips, cages, etc., winding machinery, winding and tail ropes. In the fifteen mines considered there are fifty steam engines, totaling 45,000 hp.; ten Ward Leonard winders, totaling 30,000 hp., and twelve three-phase winders, totaling 16,500 hp. Many of these are described.—*Journal of the South African Institution of Engineers*, October, 1924.

Electrophysics, Electrochemistry and Batteries

Study of Crystal Structure and Its Applications.—WHEELER P. DAVEY.—This is the first of a series of articles on crystal structure as determined by X-rays. To furnish a proper foundation for later installments, the phenomenon of X-ray diffraction by a crystal is treated in this issue under headings covering both the current theories, "Diffraction of a Spreading Wave" and "Diffraction of a Quantum."—*General Electric Review*, November, 1924.

Measurement of Hydrogen-Iron Centration.—E. B. R. PRIDEAUX.—After a brief summary of the methods which have been used for determining hydrion concentration, the scopes of the conductivity and the hydrogen electrode methods are defined, and the latter is described in detail. The potentials of the chief standard pairs of cells are tabulated and the corrections for alterations in hydrogen pressure are noted. Electrode cells, potentiometers and null point indicators are discussed and a brief survey is made of the applicability of the method to different engineering problems.—*Journal of Scientific Instruments (England)*, November, 1924.

X-Ray Examination of Metals.—T. C. DICKSON.—It is the practice at the Watertown Arsenal, Watertown, Mass., to make one casting from each pattern, which is X-rayed. If defects are found, it is generally possible by changes in the method of molding or otherwise to obtain castings free from defects or to have the defects come where they will do no harm. The cost of making the films is far less than that of cutting up the castings to ascertain their soundness. Satisfactory films can be obtained up to a thickness of about 3 in. of steel.—*Mechanical Engineering*, Mid-November, 1924.

Traction

Diesel-Electric Locomotive.—The locomotive described was designed by Prof. George Lomonossoff to make more effective use of Russian oil supplies in a country where water suitable for boiler use is not readily obtained. It has five driving axles and weighs about 120 tons. The six-cylinder, four-cycle engine, operating at 450 r.p.m. and having a maximum output of 1,200 b.-hp., is connected by a flexible coupling to an 800-kw., 600-volt to 1,000-volt generator, to which the main exciter is geared. The field of this main exciter is in turn energized by a small battery-excited generator, the control being carried out in the battery circuit, in which the current does not exceed 5 amp. The efficiency of the locomotive ranges between 21 per cent and 27 per cent.—*Engineer (England)*, Nov. 14, 1924.

Power for Transport. — A six-page résumé of papers presesnted at the first World Power Conference. Topics taken up are railway electrification in Great Britain, the United States, Austria, Germany, Italy and Sweden; a new system for main-line electrification now in process of trial in Hungary, and power for water, road and air transport respectively.—*World Power (England)*, November, 1924.

Telegraphy, Telephony, Radio and Signals

Telephone Transmission Reference System. — I. J. SIVIAN. — If telephone service is to be extended satisfactorily from one system to another, it is important that the methods of measurement employed in the two systems be equivalent, if not identical. Recently this matter has had consideration by Bell System engineers with a view to developing a new refrence system more nearly consistent with the present state of the art. The author discusses some of the considerations underlying this development and reviews progress made to date. The subject is divided into four parts, the function of a transmission reference system, requirements to be met by the transmission reference system, work done on the construction and calibration of a preliminary model of the new transmission reference system, and proposed future development.—*Electrical Communications*, Vol. III, No. 2.

Self-Inductance and Natural Wave Length of Single-Layer Coils for Radio Use. — I. YAMAMOTO. — Curves for the designing of single-layer coils, giving self-inductances, total length of wire of the coil, approximate value of the natural resonant wave length of the coil and the approximate value of equivalent self-capacity of the coil, are given.—*Journal of Institute of Electrical Engineers of Japan*, No. 435.

Scientific and Industrial Research

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Corrosion of Metals and Its Prevention, Bibliography on

An annotated bibliography containing over two thousand references to the literature of corrosion has been prepared. It covers the literature to January, 1923, and many of the entries are accompanied by brief abstracts. The entire work is carefully indexed so that references to particular subjects may be readily located. The bibliography includes the theory of corrosion of both ferrous and non-ferrous metals, electrolysis and the prevention of corrosion by alloying, metal-coating, passivity, painting, etc.—*Nathan Van Patten, Queen's University Library, Kingston, Ontario, Canada.*

Farming, Electricity in

At a recent meeting of the Virginia State Committee on the Relation of Electricity to Agriculture, held at Richmond, definite arrangements were completed between the Virginia Polytechnic Institute and the various Virginia power companies whereby research work of a comprehensive nature will be conducted to find practical means and methods of supplying Virginia farmers with electric power from central stations.—*C. E. Seitz, Blacksburg, Va.*

Furnace, Arc, Automatic Current Regulator for

Two solenoids exert a magnetic pull on the ends of a horizontal lever pivoted in the middle and held in place by springs. The current in one solenoid is proportional to the arc voltage, that in the other to the electrode current. When the arc voltage is high and the current low, the lever is pulled in one direction, closing a relay contact which causes the regulating motor to lower the electrode. Similarly, when the current is high and the voltage low, the lever is tipped in the other direction and the motor raises the electrode. Auxiliary contacts are provided which allow the control to assume a vibrating condition within about 15 per cent, plus or minus, of the normal current.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Illumination of Factories and Schools

Much useful information is expected to be gained as to the requirements of the factory lighting investigation by means of an examination of the particular conditions affecting compositors' work which is being carried out with the concurrence of the Joint Industrial Council of the Printing and Allied Trades. The architectural subcommittee has in hand research into the question of daylight lighting in buildings such as schools and factories and research into the best method of artificial lighting of picture galleries.—*National Physical Laboratory, S. W. 1, London, England.*

Time Intervals, Visual Method of Measuring Short

The operation of the machine is based on the principle of persistence of vision, enabling one to read the position of a flash of light in a Geissler tube wherever it may occur while in rapid rotation. A disk, rotated by a motor, carries a small Geissler tube back of a narrow radial slot. Concentric with the disk is a graduated circular scale, and the flash of light, being practically instantaneous, gives a readable indication at almost any speed. More than one flash may be read during a single revolution, and this gives a method of measuring the time interval between the start and finish of one or two events occurring at unexpected times.—*H. G. Dorsey, Submarine Signal Corporation, Boston, Mass.*

Oil-Sludging Apparatus

This apparatus permits the operator of a steam turbine or the manufacturer of turbine lubricants to obtain a direct reading of the amount of sludge which an oil will make over a definite period of use. It does this by subjecting the oil in a few hours to the same conditions to which it would be subjected during a great many hours of operation in a turbine. Two or more oils may be readily compared for sludging characteristics.—*De Laval Separator Company, New York, N. Y.*

Steam Condensers, Air Leaks in

Where evaporators or Zeolite softeners are used, it is very important that the leakage of cooling water into the condenser shall be kept at a minimum, since a very slight leakage will produce scale in the boilers. Some members of the Commonwealth Edison organization have developed a special electric testing outfit which we have found to be very effective for testing condenser leaks. It consists of glass jars in which samples of water to be tested are placed. Current is sent through carbon electrodes and read on an ammeter.—*J. W. Mackenzie, Consumers Power Company, Jackson, Mich.*

In Progress or Purposed

Dielectrics, Solid, Power Losses in

Data have been obtained at frequencies corresponding to from 400 meters to 3,000 meters wave length for N and K for lead glass at temperatures up to 220 deg. C. N being Schweidler's constant in the equation for dielectric absorption, and K being the exponent in the equation $R = Af\text{-}k$, where R is the effective series resistance of a condenser. The variations of N and K with temperature have been determined. The results are considered as pointing to an ionic displacement theory of dielectric absorption and dielectric power loss.—*C. F. Hill, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Insulating Materials, Deterioration of

A special sub-committee has been organized to prepare test methods for measuring the deterioration of sheet-insulating materials due to different deteriorating agencies, such as oxygen or ozone, heat, electrical tension, moisture, acidity, catalytic agents, oils and compounds, chemical agents, ultra-violet light and mechanical forces. The work will be carried out by first correlating the test methods available with the materials to which these tests could be applied, together with the uses to which the materials could be put.—*American Society for Testing Materials, Philadelphia, Pa.*

Insulating Materials Under High Hydrostatic Pressure

In connection with the investigation of insulating materials for use with submarine cables, the bureau has found it necessary to prepare apparatus for measuring the insulation resistance, capacitance and power factor under high hydrostatic pressure. This has been accomplished by covering a wire with the material to be investigated, putting the wire in a strong pipe which can be filled with water under high pressure and attaching one end of the wire to an insulated connection which is brought out through a plug in one end of the pipe.—*Bureau of Standards, Washington, D. C.*

Miscellaneous Research in England

The work on buried cables has been continued for the British Electrical and Allied Industries Research Association, and research is in progress on resistance materials and on the earthing of electrical circuits. Investigations have been carried out for government departments and other bodies relative to the current rating of copper and aluminum busbars and of low-pressure, single-conductor, lead-covered cables, as well as with reference to the fusing and safe running currents for different fuse metals.—*National Physical Laboratory, S. W. 1, London, England.*

Telephone Receivers, Cyclic Variations in Flux in

The purpose of this experimental investigation is to check the reliability of the usual theory by determining the relative extent to which the motion of the diaphragm, or of an equivalent part of the magnetic circuit, is accompanied by change in the total flux through the circuit and by change of leakage coefficient. This relative change in flux is determined by currents induced in coils at various locations. The study so far indicates that the variation in the leakage magnetic flux between the pole pieces has a different time phase from that through the permanent magnet portion of the circuit.—*G. D. Shepardson, University of Minnesota, Minneapolis, Minn.*

Suggestions for Research

Coal, Recovery of, from Refuse

The iron which is present in the ash causes the clinker to be weakly magnetic, while the combustible is non-magnetic. By passing the boiler refuse, crushed to such a size that the mechanical bond between the clinker and combustible is broken, through a magnetic field, the clinker is retained while the combustible passes on. Successful tests in Europe make the United States Bureau of Mines believe that if such equipment were available it would be used by operators who have tried without success to run at high ratings with high-ash fuels and still keep down their ash-pit losses. For details see Serial No. 2634 of the Bureau of Mines, Washington, D. C.

Dielectric Lag in Liquids

It is well known that the electric conductivity of a liquid dielectric can be increased by subjecting it to some ionizing agent, such as X-rays or radium. Whether or not such ionization also appreciably reduces the dielectric time lag remains to be investigated. If it does, this fact may later be utilized in facilitating the opening of an oil switch and in other similar devices. For some experiments in this direction see Draeger, *Archiv für Elektrotechnik*, 1924, Vol. 13, page 383.

Equipotential Surfaces, Experimental Study of

The desired field of flux is produced as a magnetic field by alternating currents of audible frequency. This field is then explored by means of a small search coil connected to a telephone head set, either directly or through a vacuum-tube amplifier. Even if the field desired to be explored is electrostatic, it can be in some cases approximated in shape by a corresponding magnetic field. For example, in a single-phase transmission circuit, consisting of two parallel conductors, electrostatic lines of force coincide with magnetic equipotential lines, and vice versa. For some experimental details see *Zeitschrift für den Physikalischen und Chem. Unterricht*, 1923, Vol. 36, page 1.

Welding, Spot, Electrodes for

The question of dies or electrodes for spot welding is of great importance. The ideal die should be able to withstand over 20,000 lb. per square inch of compression stress without distorting; it should be hard enough to resist wear from contact with the work; it should be a better conductor of electricity than copper; it should be a poor conductor of heat. The ideal die has not yet been constructed. Up to the present hard-rolled copper dies have been the best obtainable.—*W. Remington, Thomson Electric Welding Company, Lynn, Mass.*

News of the Industry

Indianapolis Rates Reduced

Commission Allows the Elimination of Demand Charges for Users of 10 Kw. or Less

INDIANAPOLIS rates affecting both the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company have been reduced, effective January 1, by an order of the Indiana Public Service Commission issued December 12. It is estimated that these reductions will save consumers approximately $200,000 yearly. The reductions affect all classes of customers, and out of the eighty thousand consumers the rates of only about one thousand will be increased. These increases are not more than 5 per cent and are merely in the nature of adjustments where demand charges are removed. Commercial customers numbering five thousand who have less than 10 kw. demand will not hereafter pay demand charges.

For residential customers the new monthly rates will effect a saving of 0.25 cent per kilowatt-hour on the first 50 kw.-hr. used, 0.2 cent on the next 150 kw.-hr. and 0.1 cent on 200 kw.-hr. The new rates are 7½ cents per kilowatt-hour for the first 50 kw.-hr., 7 cents for the next 150 kw.-hr. and 6 cents for all in excess of 200 kw.-hr. Energy for cooking, heating and battery charging served through the lighting meter will be charged 6.75 cents per kilowatt-hour for the first 50 kw.-hr. used and 4.05 cents for the remainder. Power users, both large and small, are also benefited by the rate changes.

These reductions came about as a result of an agitation started by the Chamber of Commerce. They have been under consideration by the commission since May. The changes and adjustments were due to irregularities in the interpretation of rate schedules of the two companies, particularly in the application of their demand charges.

Public Operation Amendment Defeated

Senate Votes Down Proposal to Strike Leasing Provisions from Underwood Bill—Sensational Attacks Are Made by Newspaper and by Norris

THE outstanding event of a week's protracted discussion of Muscle Shoals in the Senate was the decisive defeat of the amendment proposed by Senator Smith of South Carolina, which would have struck out all of the leasing provisions of the bill. The vote, which was taken December 16, was thirty-two to forty-nine. Thus the Senate emphasized its disapproval of outright public operation of the properties.

Despite the unexpected and prolonged opposition to the Underwood bill in the Upper House, the expectation as this is written is that the measure will pass in virtually its present form. The legislators are beginning to speculate on what may happen in the House. Since the Underwood proposal is a substitute for the Ford bill, which originated in the House and which was passed by that body, ordinarily the next legislative step would be for the House to request a conference. In this instance, since the House has had no opportunity to consider a radically different measure, it is understood that an effort will be made to bring about the recommitment of the bill so that the committee on military affairs may study it.

The prolonged debate of the Underwood substitute in the Senate has produced little new thought on the proposition. Many Senators have insisted on going over the situation in their own way. The debate has revealed a great lack of information as to power production and distribution on the part of some of the Senators.

The Washington *Herald* printed a sensational editorial on December 13 declaring the real purpose of Senator Underwood's bill to be to "give" Muscle Shoals to the Alabama Power Company and attempting to parallel the proposed law and the Teapot Dome scandal. At the request of the Alabama Senator the newspaper article is being made the subject of a senatorial investigation. To those who have followed the Muscle Shoals development from its inception it has been very clear that Senator Underwood's ideas have been at complete variance with those of the Alabama Power Company. The Senator in his turn says opposition to his bill comes from the fertilizer interests.

Attack on the President

An even more sensational incident was an attack made on President Coolidge in the course of Wednesday's debate by Senator Norris of Nebraska, protagonist in the Upper House of government ownership and operation. Asserting that the President is in command of the "legislative ship," with Senator Underwood standing at his right, Mr. Norris said:

"That ship is headed straight for Wall Street and carries a deed of conveyance to the electric water power trust of America for one of the greatest inheritances of unborn generations of American citizens.

"I have in mind," Senator Norris continued, "to give the Senate the benefit of some information I have obtained. I have had five or six investigators going into the matter for the last four or five days. For instance, I call attention to what I believe to be the connection of the Alabama Power Company with the water-power trust. I was amazed, and if the investigators are correct, a complete investigation of the matter will be almost a mathematical demonstration of the fact that today there is not in the United States a place where this mighty trust does not have its hold.

"You can trace the electric light in Omaha and the electric light in the South, and they both wind up in Wall Street. It would not be so awful if we were not facing an electrical age, if we were not facing a day not far distant when every humble home, every farmer, every business man would be directly interested in the proposition. When that day comes we shall wake up and find that the whole thing is in the control of Wall Street through one company, either directly or indirectly.

"It is a mammoth task," Senator Norris declared, "to take up the thousands of names connected with the various power companies over the United States. Ninety-nine times out of a hundred, when we trace them to the end, we shall find that we have reached the General Electric Company. We are in the grip of the water-power trust."

The prospects now point to the ultimate adoption of legislation referring the entire matter to a joint commission. This may mean that no definite disposition of the property will be made until next winter. Although the Wilson Dam will be completed before July 1, it is pointed out that time will be required to get the generators into working order and to prepare the plant for the delivery of power. The primary power at least can be made available for distribution by using the transforming facilities at the Sheffield steam plant. That would make available 120,000 kw., and it is believed that the Alabama Power Company will devise means for insuring the distribution of this power so that it may be utilized during the interim when the settlement is being arranged.

Colfax Plant of Duquesne Company Is Complete

The third and last 30,000-kw. turbo-generator to be installed at the Colfax plant of the Duquesne Light Company at Pittsburgh will go on the lines in the next two weeks. With the 60,000-kw. machine that preceded these units, this will bring the total rating of Colfax to 150,000 kw., its full capacity.

Very soon ground will be broken at Shippingport, in Beaver County, on the Ohio River, for the company's new power house, to be known as the Beaver station. It will have an ultimate capacity of 375,000 kw. and will cost around $30,000,000. This station, Colfax and Brunot Island would form the points of a triangle that might be drawn within the 66,000-volt transmission ring surrounding industrial Pittsburgh.

Electricity in Mines

West Virginia-Kentucky Engineers Discuss Practical Problems at Huntington

HUNTINGTON, W. Va., was the scene of the fourth annual meeting of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers on December 12 and 13. No exhibit was held this year, but the attendance was very fair and the discussions were spirited. R. R. Webster of Weeksbury, Ky., the president, conducted the program.

Byron B. Minnium read a paper on voltage control in mines which led to a long discussion on batteries. A representative of the Electric Storage Battery Company described two mine installations in Illinois. In one instance old batteries raised the minimum voltage delivered to the 13-ton locomotives from 75 to 175. In the other case battery locomotives were used to operate the fans and pumps, so that it was necessary to run the power plant only one day a week. An important emergency use for which a locomotive battery should be employed was described by Mr. Webster—excitation in a mine power plant where alternating-current generators are used. In getting the generators back on the line after a shutdown the temporary operation of a steam-driven exciter is necessary. If the exciter breaks down, then a forty-cell to sixty-cell battery can be used to take its place.

The benefits of storage batteries in gaseous mines were enumerated as follows: Increased speed of cutting because of improved and constant voltage, elimination of delays caused by power interruptions, elimination of bonding expense, elimination of trolley wires and reduction of peak loads.

J. H. Edwards took the place of F. A. Signer in describing the methods of the electrical department of the Southern Mining Company, and a general discussion of how to get co-operation between foremen and electricians followed. Mr. Edwards also read a paper on reducing costs by the proper supervision of mechanical and electrical equipment. He cited instances where electrical men had effected appreciable savings and others where opportunity was not seen until too late. The discussion brought out a belief on the part of some that the nose of the electrical man was kept so close to the grindstone that he had no great opportunity to figure out ways to save expense.

The importance of keeping in stock small inexpensive repair parts difficult to obtain on short notice and the desirability of insurance against breakdowns were emphasized by the speakers.

AUTOMATIC SUBSTATIONS

E. L. Hough of the General Electric Company gave a short talk on automatic substations, and a film was shown which made clear the step-by-step operation of relays and automatic contactors. In reply to a question Mr. Hough said there was little difficulty in paralleling converters but much difficulty in paralleling motor-generators which are overcompounded. The difficulty arises when a cold machine is added. As it warms up, the percentage of the load carried will change materially unless the field rheostat is adjusted. A current-balance regulator now available does this automatically.

F. M. Reigher said he had overcome the difficulty by using machines designed for flat compounding. He read an instructive paper in which the rotary converter was compared with the motor-generator, analyzing their respective characteristics and comparing costs of manual and automatic types. The over-all efficiency of the converter was found to be 5 to 8 per cent higher than that of the motor-generator. In the discussion of this paper the rotary converter was conceded to "win out" except in the matter of power-factor correction.

Electric welding for shop repairs, correct methods of installing feeders in bore holes and the correct application of carbon brushes were the subjects of other papers and discussions.

Banquet to Owen D. Young

Chairman of General Electric Board Made Recipient of Remarkable Tribute Because of His Part in Framing and Administering Dawes Plan

FEW men in the electrical industry have ever received so remarkable an honor as that paid in New York City on Thursday evening, December 11, to Owen D. Young, chairman of the board of directors of the General Electric Company, when a thousand leaders in different walks of life tendered him a banquet at the Waldorf-Astoria Hotel. The tribute had nothing to do with Mr. Young's prominence in the electrical industry, but signalized the great success with which in the first instance he had co-operated with General Charles G. Dawes and Henry M. Robinson to frame the reparations agreement known as the Dawes plan and in the second instance had performed the duties of administrator of this plan until it was well launched and could be left to the guidance of another.

O. D. YOUNG

The banquet was a brilliant affair, the main ballroom of the hotel being draped in Allied colors from top to bottom. A representative of the French Republic invested Mr. Young with the cross of a commander of the French Legion of Honor, the banqueters standing up and bursting into cheers.

President Coolidge sent a message which was read by George W. Wickersham, former United States Attorney-General, who was the toastmaster. In his message the President said: "The commission's work is now recognized as a great contribution to re-establish economic order in Europe, and the distinguished part which Mr. Young bore has earned for him the gratitude of peoples on both sides of the Atlantic." Other messages of appreciation came from Premiers Baldwin of Great Britain, Herriot of France, Mussolini of Italy and Theunis of Belgium, while Vice-President-elect Dawes sent a note in high praise of his former associate. Spoken tributes came from Herbert Hoover, Secretary of Commerce; Richard F. Grant, president of the Chamber of Commerce of the United States; Governor Albert C. Ritchie of Maryland and William Church Osborn. Sir Robert M. Kindersley, English economist, banker and business leader, sent a radio-telegraphic message, "My warmest greetings," which, by the use of the new Ranger process, was reproduced in fac-simile penmanship on a screen back of the speakers. An encomium from Secretary of State Hughes was heard over the long-distance telephone from Washington.

Among men prominently associated with the electrical industry who were present were H. M. Addinsell, J. E. Aldred, P. S. Arkwright, M. H. Aylesworth, A. J. Baldwin, R. H. Ballard, N. F. Brady, C. A. Coffin, H. L. Cooper, F. L. Dame, J. E. Davidson, Alex Dow, H. M. Edwards, F. M. Feiker, Samuel Ferguson, W. W. Freeman, J. F. Gilchrist, W. L. Goodwin, F. T. Griffith, Edwin Gruhl, A. G. Hodenpyl, E. N. Hurley, M. J. Insull, Samuel Insull, F. B. Jewett, W. H. Johnson, John W. Lieb, J. B. McCall, William McClellan, E. J. Mehren, J. B. Miller, S. Z. Mitchell, T. E. Murray, W. S. Murray, L. A. Osborne, R. F. Pack, H. H. Porter, W. E, Robertson, M. E. Sampsell, David Sarnoff, Paul Schoellkopf, M. S. Sloan, F. W. Smith, C. W. Stone, B. E. Sunny, Gerard Swope, H. B. Thayer, G. N. Tidd, Philip Torchio, Calvert Townley, Guy E. Tripp, H. A. Wagner, W. F. Wells, P. H. Gadsden and Arthur Williams.

MR. YOUNG'S SPEECH

Mr. Young spoke at some length, dwelling modestly on his own part in European stabilization but paying high tribute to his colleagues in the conference, both those from the United States and those representing European countries. He praised the prime ministers of the nations participating, including Chancellor Marx of Germany; expressed his appreciation of the ef-

forts of the Washington administration, to aid the work, gave an account of the inauguration of the plan and the initial stage of its operation, voiced the hope that some day the United States would "establish a definite foreign policy and maintain its continuity free from the horseplay of domestic politics even with changing administrations," and uttered an optimistic conviction that there is "a real hope of a new day in the world—a day in which human beings in all countries may live peacefully and develop and work and save."

Edison Medal to Howell

Engineer of Harrison Lamp Works of General Electric Company Gets High Award

THE Edison Medal for the year 1924 has been awarded by the Edison medal committee of the American Institute of Electrical Engineers to John White Howell of Newark, N. J., "for his contributions toward the development of the incandescent lamp."

John W. Howell, engineer and inventor, was born in New Brunswick, N. J., on December 22, 1857. After leaving school he went to the College of the City of New York, where he took an academic course for a year and a half. He then went to Rutgers College, where he studied engineering for a year, and finally to Stevens Institute, where he finished a special engineering course in 1881. Later, in 1898, he received the honorary degree of electrical engineer from Stevens Institute.

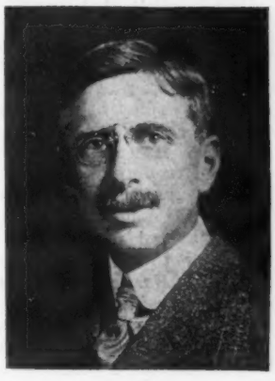
On July 6, 1881, Mr. Howell entered the employ of the Edison Lamp Company at Menlo Park, N. J. At that time the lamp industry was in its infancy, without machinery and without methods. For several years the technical work at the factory was supervised by Mr. Edison. Then he gradually withdrew and eventually left the work in Mr. Howell's charge. In the forty-three years that have passed since 1881 Mr. Howell has remained with the Edison Lamp Works, and his numerous important inventions and many written contributions have been vitally constructive factors in the improvement and enlargement of incandescent-lamp production.

Two of his earliest achievements were his development of a successful portable voltmeter and a Wheatstone bridge type of potential indicator, which compensated for temperature and which was widely used in central stations and electric light plants. At a later date Mr. Howell originated the comparative indicator, a novel system which gave the voltage at each feeder end by comparison with one standard indicator.

In 1886 he determined for the first time the relation between the life and the candlepower of incandescent lamps, and his study has applied to all forms of incandescent lamps made since that time. The next year he introduced a carbonaceous paste clamp which greatly decreased clamping and filament costs and greatly increased the quality of the lamp. When, in 1890, he was appointed technical adviser to manager of works, he made certain changes in the exhaust which increased the speed of exhaust and improved the quality of the lamp.

In 1892, the year the Edison Lamp Works became part of the General Electric Company, Mr. Howell was appointed engineer and assistant manager of the lamp works. His experimental investigations continued. He organized the Edison Lamp Works engineering department. He improved the Thomson-Houston method of treating carbon filaments and developed a treating machine which entirely revolutionized the most important process in lamp making. He introduced the squirted cellulose filament which reduced the number of operators in the filament department from 350 to twelve. As an inventor and an engineer and a manager Mr. Howell was ever a moving force in the direction and development of the then new industry of lamp manufacture. His influence and his many technical achievements cannot easily be cataloged. His patents, numbering forty-three in all, cover a wide variety of inventions of part processes and machinery used in the evolution of the electric lamp.

He resigned as assistant manager



J. W. HOWELL

in 1895, as the engineering duties were more congenial and demanded all of his time. In that year he investigated, reported favorably upon and introduced the Malignani methods of exhaust, whereby production was enormously increased. With W. R. Burrows he designed and patented the first stem-making machine, which revolutionized that process and is still in use today. He tested and investigated various filament inventions and assisted Dr. W. R. Whitney in the development of the metallized filaments. In 1906 much of his time was spent in Europe for the purpose of studying the invention of the tungsten lamp and acquiring American rights.

Today he is the most distinguished of American pioneer incandescent-lamp engineers. In the evolution and development of that lamp he has rendered invaluable services. For forty-three years he has carried on an enormous amount of research work which has given the incandescent lamp its present universal usefulness. The general public, as well as the entire electrical industry, have enjoyed the results of his labors; and, as the lighting branch was the parent of the light and power industry as it is known today, it is certain that Mr. Howell has played a most important and distinguished part in the scientific progress of his day.

Mr. Howell is a fellow of the American Institute of Electrical Engineers, member of the American Society of Mechanical Engineers, National Electric Light Association, Association of Edison Illuminating Companies, Illuminating Engineering Society and Franklin Institute and past-president of the Edison Pioneers.

Government Abandons Revision of Radio Wave

Reallocation of wave lengths to radio broadcasting stations, as recommended to the Secretary of Commerce by the recent national radio conference, has been abandoned by the Commerce Department. A plan which had been formulated has been made obsolete by the increasing number of broadcasting stations and the demand for wavelength assignments, officials say. It is understood that until the radio broadcasting situation becomes more stable no attempt will be made to revise the present allocation of wave lengths, although the department will meet the increasing demands so far as possible.

I. E. S. Considers Methods of Selling Better Lighting

In an address on "Applied Illuminating Engineering," delivered before a meeting of the New York Section of the Illuminating Engineering Society, on December 15, Julius Daniels, illuminating engineer of the Edison Electric Illuminating Company of Boston, described practical methods of selling better lighting to stores, offices, factories, public institutions and the home. One of the essential features in the successful sale of improved illumination, he pointed out, is the proper scheduling of effort on different classes of lighting customers at the most suitable time of the year. For instance, store and window lighting should be sold during the late summer and fall months, so that installation of equipment can be completed in time not to interfere with merchant's Christmas business.

A plea for greater consideration on the part of illuminating engineers of the methods of actually selling better lighting facilities on a large scale was made by George A. Stickney, who declared that commercial application is lagging too far behind technical development. It was also brought out that one of the most difficult problems which face the lighting departments of central-station companies is a satisfactory means of convincing the small store owner.

Insull Denies Purchase of Terre Haute Property

A rumor current in Indianapolis financial circles that the Insull interests have acquired the Terre Haute, Indianapolis & Eastern Traction Company was emphatically denied on December 12 by Martin J. Insull, president Middle West Utilities Company.

N. E. L. A. Committees Hard at Work

Public Policy, National Executive and Public Relations Section Executive Members Meet at New York and Listen to Encouraging Reports

MEETINGS of the public policy committee, the national executive committee and the executive committee of the Public Relations National Section of the National Electric Light Association were held in the Engineering Societies Building, New York City, on December 10, 11 and 12. Meetings of several sub-committees of the Public Relations Section also were held during the week. The public policy committee meeting was one of the best in point of attendance, only three members being absent.

The national executive committee meeting was presided over by President Franklin T. Griffith. Reporting for the rural service committee, Chairman G. C. Neff said that the prosperity of the farmer during the last few months makes even more imperative than heretofore activity upon the part of company members in extending their rural lines and in co-operating with the Committee on the Relation of Electricity to Agriculture in its studies, now being conducted in thirteen states. A resolution was adopted urging geographic division officials to undertake the formation of rural service committees in all states within their divisions and calling for reports at the March meeting of the executive committee.

The home-lighting contest was a greater success than had been anticipated, according to the report of Chairman J. E. Davidson. Satisfactory reports were presented by the chairmen of the four national sections and from the presidents of the geographic divisions. The creation of a new committee on street and highway lighting with E. W. Lloyd of Chicago as chairman was announced by Chairman W. R. Putnam of the Commercial Section. Recognition was given by the executive committee to the necessity for building up commercial organizations in order that the load factor may be increased and new revenue produced to offset increased costs. The committee unanimously authorized the employment of a director of engineering, in addition to the present staff of the engineering department. In order to bring about closer co-operation between the manufacturers and the N. E. L. A., the executive committee authorized the officers of the association to act as a conference committee with a similar committee from the Electrical Manufacturers' Council.

REDUCTION OF INSURANCE PREMIUMS

Revision of premium rates in both fire and casualty insurance effected through the work of the insurance committee result in an actual annual saving to member companies of more than one million dollars per year, according to the statement of Chairman Charles B. Scott of the insurance committee. Mr. Scott was authorized to act on behalf of the association in co-operation with the Western Association of Electrical Inspectors to secure a revision of the National Electrical Code in respect to rules for stations and substations. He asserted that the Western Association has agreed to the proposal to separate rules for stations and substations from the National Electrical Code and prepare them as a separate set of rules. At the suggestion of E. W. Lloyd, President Griffith was empowered to change the present N. E. L. A. representation upon the electrical committee of the National Fire Protection Association so that the commercial end of the electric light and power business may have a voice in determining matters coming before that committee.

N. E. L. A. educational courses are in greater demand than ever before, according to the report of Chairman F. R. Jenkins. More than eight hundred courses have been subscribed to during the last few months. Mr. Jenkins reported upon textbooks now in use in public schools, asserting that many of them carry obsolete information regarding public utilities and a number of them carry material prejudicial to the interests of the public and of the electric light and power industry. He reported that he had been authorized to represent the Public Relations Section as a member of a joint public utility committee to recommend action looking toward the creation of textbook material.

It was resolved not to hold an exhibit in connection with the 1925 convention at San Francisco, owing to lack of facilities. An invitation from Louisville to hold the next meetings of the national executive committee and public relations executive committee in that city was accepted. The meetings will be held on consecutive days during the month of March at the call of the president.

PUBLIC RELATIONS MEETING

On the Wednesday preceding the national executive committee meeting the Public Relations Section executive committee met and was addressed by President Griffith, who urged the executives present not to be misled by the fact that radicalism had been defeated at the polls in November. He said that the work of building better public relations and better public understanding should be continued even more aggressively than heretofore. This sentiment was indorsed by R. H. Ballard, who reviewed the water-power shortage in California and spoke appreciatively of the spirit of co-operation shown by the electric light and power companies, the California Railroad Commission and the public in bridging over the period of power shortage.

An outline of activities of the headquarters staff was given by Managing Director Aylesworth. Miss R. E. McKee, chairman of the women's public information committee, reported that in all divisions women are taking an active interest and are particularly active in public speaking. At her suggestion a member of her committee will be appointed to the public speaking committee of the section, and the committee on relations with educational institutions will carry on its work actively with the women's educational institutions as well as with institutions for men and coeducational institutions.

The committee on co-operation with educational institutions, of which John C. Parker is chairman, will outline and present to the committee for consideration at its March meeting a plan for supporting public utility research work by a number of the leading colleges and universities of the country. This work, it is stated, will necessarily continue over a period of years, but will result in the collection of basic information necessary for the preparation of adequate textbooks upon public utilities.

Customer-ownership activities are increasing, many companies having joined the program during the last few months, but it was estimated by A. E. Wishon, chairman of the customer-ownership committee, that, in spite of this increased activity, the number of shares and the total value of securities disposed of to customers, employees and the public under this direct sales plan probably would not be so great for the year 1924 as for the preceding year. He explained this by the statement that many of the larger companies have met their financial requirements and therefore are not aggressively participating in this activity at present.

Announcement was made by Chairman M. S. Sloan of the Public Relations Section, who also is chairman of the committee on relations with financial institutions, that the American Bankers' Association and the Investment Bankers' Association of America have formed public utility securities committees with a view to assisting in the movement toward revising and inaugurating state laws which will legalize the investment of savings-bank deposits and trust funds in sound public utility securities.

A report to the committee from the manufacturers' advertising committee indicates that the manufacturers will again during 1925 co-operate in the good-will movement by devoting a considerable portion of their advertising space in popular magazines to copy designed to inform the public regarding the electric light and power industry.

EMPLOYEES' MANUAL

At all three of the major meetings of the week indorsement was given to the plan of placing a copy of an employees' manual, prepared and published by the association, in the hands of every employee of member companies. This manual relates the fundamental facts of the industry and of the activities of the various departments of individual companies.

At a meeting of the committee on co-operation with educational institutions held on Tuesday it was announced that a textbook on public utilities which has been in course of preparation for several months will be in completed manuscript form and in the hands of the committee for editing and revision not later than January 1. Arrangements have been made for the publication of this textbook, and efforts will be made to place it in all institutions of higher learning in the country.

Curbs Commission's Power

Wisconsin Supreme Court Exempts Mutual Utility Companies from Its Jurisdiction

RULING that the Lincoln Highway Light Company, a group of neighbors buying electricity and distributing it among themselves, is not a public utility and that the Railroad Commission of Wisconsin has no jurisdiction involving the regulation of its business, the Wisconsin Supreme Court has upheld the decision of the Dane County Court vacating an order of the commission which, holding the line to be a public utility enterprise, required the Lincoln company to supply energy to certain persons who had demanded service. In handing down this decision, which brings to a close a dispute extending over years and previously referred to in the ELECTRICAL WORLD for January 19, 1924 (page 161), May 5, 1923 (page 1058) and September 23, 1922 (page 683), the Supreme Court declared that the Lincoln company enjoys no monopoly, asserting that if this neighborhood association is a public utility, then where three or four neighbors band together to share the expense of carrying their milk to a creamery or cheese factory they become common carriers. The Lincoln company undertook to render no service but constructed a private line by means of which the city of Manitowoc's municipal electric plant was enabled to render a service to them.

The decision is regarded as a serious blow to the jurisdiction of the Railroad Commission in regulating the operations of mutual utility companies in business through the state, and in consequence of it enactment will be sought at the coming session of the Legislature of a law providing for the regulation by the commission of all such associations. The ruling leaves mutual companies open to competition without regulation or restrictions. According to Chairman Gettle of the Wisconsin commission, many of the mutual companies prefer to be within the jurisdiction of the commission owing to the protection they thus gain. As a result of the ruling private associations or groups can now go into the public highways and construct lines for private use. This, the commission maintains, sanctions a policy not within the requirements of the laws of the state.

First Decision on Eminent Domain Under Robinson Law

The Public Service Commission of New York this week announced its first decision affecting the rights of a private corporation under the eminent-domain provisions of the Robinson water-power law of the state, passed in 1921. The commission decided that certain lands and water rights on the Salmon River in the town of Orwell, Oswego County, owned by R. W. Horton and others, are necessary for the development of a single water-power site by the Niagara, Lockport & Ontario Power Company. The evidence showed that the Niagara company owns 28 ft. of the head of 50 ft. within the project area, the Hortons owning the remaining 22 ft. It also showed that the Niagara power site is capable of developing approximately 10,000 hp., whereas the power site claimed by the Hortons would develop only about 3,000 hp. The development of the Horton site would prevent the development of the Niagara site, and likewise the development of the Niagara site would prevent the Horton development.

The commission points to the language in the statute as an indication that the Legislature had in mind the combination of separate water-power sites into a single development for the production of power for public uses, to the end that power may be generated at the least production cost, and asserts that public interest will be best served by development of the larger site. The constitutionality of the law was attacked by the land owners, but the commission held that constitutionality must be left for the courts to determine.

Supreme Court Hears Argument in Chicago Canal Case

Arguments in the appeal of the Chicago Sanitary District from a decision of the United States District Court granting the government an injunction against the diversion of water amounting to 10,000 cu.ft. per second from Lake Michigan, although only 4,167 cu.ft. was authorized in the permit issued by the Secretary of War under authority of Congress, were presented before the United States Supreme Court on December 8 and 9.

Members of the court evinced keen interest in the issues presented and counsel were interrupted by frequent questions from the bench. From the tenor of these questions the indications are that the Supreme Court will sustain the injunction, about the only point which appears in doubt being the time which will be granted the Chicago district to make other arrangements for disposal of its sewage before the injunction shall be made fully operative. Counsel for the government did not admit that 10,000 cu.ft. per second from Lake Michigan is necessary to carry Chicago's sewage down the canal and thence toward the Gulf of Mexico, contending, on the contrary, that the excessive withdrawal of water from the lake is due to a power scheme rather than to purely sanitary needs. The court displayed much interest in whether the present rate of diversion actually is lowering the level of Lake Michigan and interfering with navigation. This was denied by counsel for the Chicago Sanitary District, but affirmed by counsel for opposing interests.

Solicitor General James M. Beck made the principal argument for the government. Andrew B. Dougherty, Attorney-General of Michigan, argued in behalf of that state and of Indiana, New York, Ohio, Pennsylvania, Wisconsin and Minnesota, which intervened in the case in opposition to excessive diversion. Inasmuch as the Supreme Court has a voluminous record and many briefs to examine in the case, an early decision is not expected.

Report on Charges Against Ontario Hydro Men

The report of Judge Colin G. Snider, who investigated the charges against officials of the Hydro-Electric Power Commission of Ontario contained in a letter written by Clarence E. Settell, former secretary to Sir Adam Beck, chairman of the commission, has been made public and shows that only nineteen out of eighty-five accusations are true or partly true. Settell, as stated in the ELECTRICAL WORLD last week, has been sentenced to three years' imprisonment for attempted embezzlement of the commission's funds.

Only charges of a very trivial kind against Sir Adam Beck are found to be substantiated. All of the important charges against the chairman, such as those involving wrongful expenditures of large sums of money for rental and furnishing of Sir Adam's apartments, disbursement of Hydro funds for the London sanitarium and forging of certain contracts, are found to have been false.

Chief Engineer F. A. Gaby was found to have recommended the appointment of his brother to the medical staff of the commission, and the sale to the Hydro commission of a machine shovel from a plant owned by Mr. Gaby was condemned.

I. B. Lucas, K. C., Hydro solicitor, was found to have shown "censurable nepotism" in the conduct of the legal department, and sums paid by him for services rendered to the Hydro Commission were pronounced excessive.

Utah Power & Light to Build New Bear River Plant

The State Engineer of Utah has approved the application of the Utah Power & Light Company for the diversion of 2,500 second-feet of the unappropriated waters of the Bear River, with storage for 75,000 acre-feet. This means that work will begin in the near future on the construction of a hydro-electric power plant by that company on what is known as the Cutler site, on Bear River, in Box Elder County, Utah. The plant will consist of two units, each with a rating of 15,000 kw. When they are operating at capacity about 3,500 cu.ft. of water a second will pass through the turbines under a head of 128 ft. The dam will be built a short distance above the plant. It will be of concrete construction and of the combination gravity and arch type. The crest of the dam will have a maximum height of 110 ft. above bedrock, and its length over all will be about 500 ft.

This new plant will be the largest hydro-electric plant in Utah. On the company's system it will be second in size to the Grace (Idaho) plant, also on the Bear River, where there is 44,000 kw. installed capacity. The construction program involves an expenditure of about $5,500,000 and the employment of a thousand men for a period of two years. It is expected that actual construction work on the new hydro-electric plant will be under way by March 1, 1925.

Senator Howell Thinks Rates in Many Cities Exorbitant

In the course of a speech on the Muscle Shoals bills last Saturday Senator Robert B. Howell of Nebraska went out of his way to attack the Potomac Electric Power Company as regards its rates in the District of Columbia. The Senator called the 10-cent rate which is being charged and impounded by the courts pending settlement of the disputed valuation of the company "ridiculous" and went on to make comparisons with the rates charged in Cleveland, Lincoln and Omaha, where municipal plants exist or the private companies have been "threatened" with them. He instanced Niagara Falls, N. Y.; Burlington, Iowa; Quincy, Ill.; Bessemer, Birmingham and Montgomery, Ala.; Atlanta, Ga.; Nashville, Tenn., and other cities as places where electricity costs from 88 to 236 per cent more than in Cleveland. Senator Howell declared: "It is not the cost of the primary power; it is the cost of distribution. That is where these companies put on their exorbitant profits."

State Supreme Court Rules Against Aberdeen, Wash.

The Supreme Court of the State of Washington has upheld a lower court which, as recounted in the ELECTRICAL WORLD for August 30, page 430, prohibited the city of Aberdeen from proceeding with the sale of the $2,000,000 in bonds voted in December, 1923, for the construction of a hydro-electric plant and water system on the Wynooche River in Grays Harbor County. The lower court had declared the election void because it involved the financing of two separate projects from one bond issue. The city proposed to dam the Wynooche River for the purpose of generating 34,000 hp. and to divert some of the water into its present domestic water supply system. Action to enjoin the city from proceeding with the sale of the bonds was brought by a taxpayer.

Canadian Minister Gives Status of St. Lawrence Project

According to a statement issued by George P. Graham, Canadian Minister of Railways, an agreement has been reached between technical officers representing Canada and the United States as to the questions to be answered by the enlarged joint engineering board which will report on the proposed St. Lawrence development. The agreement marks the conclusion of negotiations extending over several months. Under the arrangement arrived at between the two countries, these terms of reference will now go to the respective national advisory committees, to be reported upon by them to the governments of each country, which will have final powers. Canada has, it is understood, endeavored to confine the terms of conference to such questions as had an actual bearing upon the St. Lawrence problem. The St. Lawrence scheme will come before the Canadian Parliament at the approaching session in the form of a resolution asking for action in support of the findings of the International Joint Waterways Commission.

From Washington it is stated that nothing took place at the recent meeting of the international engineering board to justify certain newspaper articles which said that the meeting was a "victory for the Canadian viewpoint." The truth of the matter is that the meeting simply was a discussion of the engineering phases of the problem. No formal action of any kind was taken. It is understood that the Canadians seemed to be entirely willing to recede from their first suggestion that there be no discussion of diversion at Niagara Falls.

Public Ownership in Panama Threatens Investments

A bill passed in the Assembly of Panama last week to permit the construction and operation by Panama City of power and light plants to compete with the Panama Power & Light Corporation has aroused concern among American investors. The Panama Power & Light Company, which has a capitalization of $4,000,000, was financed exclusively in the United States. The Electric Bond & Share Company, New York, acts as its fiscal agent. Its plants were erected in 1916 and serve a population of 71,000. News of the passage of the measure was cabled by C. F. MacMurray, the manager of the company, to the Electric Bond & Share Company. The Governor of Panama may not approve the bill.

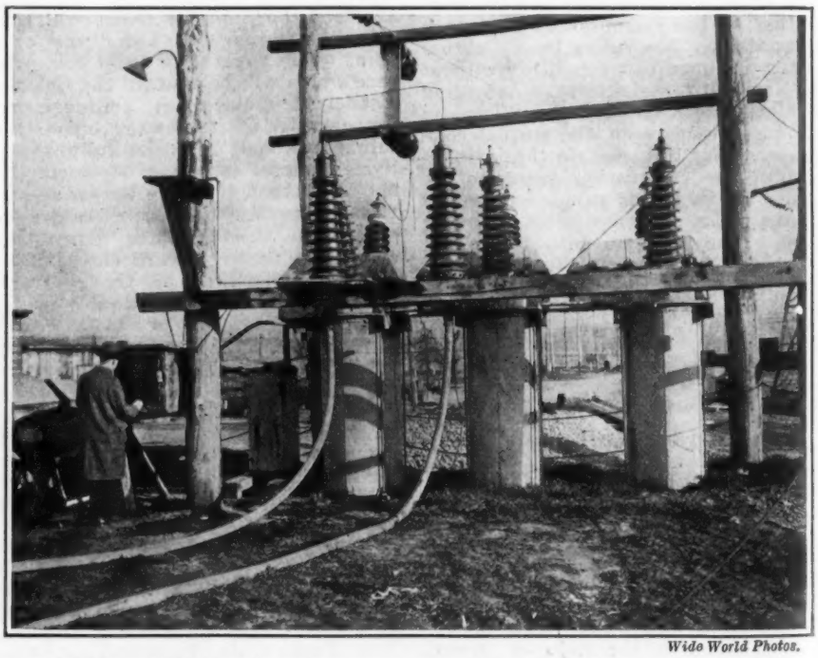
Tri-State Delaware River Compact Makes Progress

The Tri-State Delaware Treaty Commission, composed of representatives of New York, New Jersey, Pennsylvania and the federal government, has been holding meetings for several months and has, it is said, considered a large number of drafts of the proposed agreement for the partition of the Delaware's waters both for waterworks and power among the three states concerned. The latest meeting of the commission took place this month at Atlantic City.

According to a purported but not official synopsis of the agreement, it will provide, generally, that above the New York and New Jersey state line, or above Port Jervis, the three states shall each have right to a third of the water supply above a reserve minimum level which will always be maintained. New York will have a right to one-third of the water below the state line, provided that such water flows into the Delaware from New York tributaries, while New Jersey and Pennsylvania each will have half of the water below the state line where such water comes from tributaries also below the line.

The agreement is expected to end all disputes as to state rights in the Delaware River where heretofore no rights have been established except common rights. George MacDonald of New York is chairman of the commission, on which Col. J. M. Slattery represents the United States War Department. (See ELECTRICAL WORLD for September 27, page 701.)

America's Highest-Voltage Cable



Wide World Photos.

A CABLE which is now under commercial test at the North Albany switching station of the Adirondack Power & Light Corporation on its 110,000-volt circuit, and which was manufactured by the General Electric Company, is here shown. The voltage named is the highest at which any underground cable has ever been operated in this country. The nearest approach to it is the 66,000-volt cable recently put into use by the Cleveland Electric Illuminating Company and described in ELECTRICAL WORLD, March 22, page 591.

New Texas Central Station

Subsidiary of American Power & Light Company, Near Trinidad, to Burn Lignite

CONSTRUCTION work will be begun soon on a new electric generating station to have an ultimate installed capacity of 150,000 kw. and an initial capacity of 40,000 kw. by the Texas Public Utilities Company, Dallas, an operating subsidiary of the Southwestern Power & Light Company, the latter company being controlled by the American Power & Light Company. The new station is to be built in the Texas lignite fields on the Trinity River near Trinidad, about 65 miles southeast of Dallas. It will be one of the largest, most modern, most efficient plants in the Southwest and is expected to be in operation during the summer of 1926.

In connection with the plant there will be utilized a natural reservoir approximately one and one-half miles in length and three-quarters of a mile in width, having an area of about 800 acres, which will be used as storage for condensing water. On two sides of this reservoir there is now a natural embankment, and a dike approximately two miles in length will be built to inclose the other two sides. The reservoir will be filled from the Trinity River, and the water supply will be maintained throughout the year by pumping from the river when necessary.

The company has bought, or has under option, approximately 3,000 acres of lignite beds in the immediate vicinity of the plant site. These lignite beds are believed sufficient to operate the station for twenty years, while other large beds of lignite not now under option are available in the vicinity. Lignite will be carried from the beds to the generating station by an electric railway.

INITIAL INSTALLATION 40,000 KW.

The plant will be built on the unit plan. The initial installation will consist of two 20,000-kw. units, together with four high-pressure, high-superheat boilers, each having 20,000 sq.ft. of heating surface. The boilers will be equipped to burn lignite, while provision will also be made in the design of the building so that oil or gas burning equipment may be readily installed later should a change of fuel be found economical.

Power from the station will be fed into the extensive interconnected transmission system of the electric operating subsidiaries of the Southwestern Power & Light Company, including the Texas Power & Light Company, the Fort Worth Power & Light Company, the Wichita Falls Electric Company and the Oil Belt Power Company. This interconnected transmission system covers the district extending from Taylor on the south to Wichita Falls, Denison and Paris on the north, an air-line distance of approximately 225 miles, and from Brownwood and Eastland on the west to Tyler on the east, an air-line distance of approximately 210 miles. The area thus covered is in excess of 47,300 square miles, approximately the size of New York State. The high-voltage transmission system in this territory, which is now entirely interconnected, aggregates about 1,900 miles in length. The companies supply electric power and light service to 150 communities in this territory, and all except eight are now served from the transmission system.

Briefer News

New Jersey Companies Seek Permission to Merge.—The Eastern New Jersey Power Company, a subsidiary of the Utilities Power & Light Corporation, has applied to the New Jersey Board of Public Utility Commissioners for permission to acquire the Electric Light & Power Company of Hightstown, N. J., and the Jamesburg Electric Company of Jamesburg, N. J., which are being connected by a transmission line.

Doherty Company Buys 60 Wall Street.—Henry L. Doherty has announced that the Cities Service Company has purchased the office building at 60 Wall Street, New York, which has been the company's head office for many years, and that this purchase, with the company's other holdings, has made Cities Service the most extensive owner of downtown New York real estate.

Bankers Inspect Big Power Plants.—Bankers and other financial men from New York, Boston and other Eastern cities made an inspection trip last week to electric light and power properties in Pennsylvania which are operated by W. S. Barstow & Company and in whose securities the visitors are interested. The plants visited were those at Reading, Easton, Lebanon and the new plant of the Metropolitan Power Company at Middletown, where the first 30,000-kw. unit was recently completed.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 5 issue, page 50, for latest list.]

New England Electrical Credit Association—Boston, Jan. 13. C. A. Kane, 99 Bedford St., Boston.

Kentucky Association of Public Utilities—Louisville, Jan. 15-16. E. F. Kelley, Louisville Railway Co., Louisville.

American Engineering Council—Washington, Jan. 16-17. L. W. Wallace, 26 Jackson Place Washington, D. C.

Electrical Safety Conference—New York, Jan. 21. R. B. Shepard, 109 Leonard St., New York.

Western Association of Electrical Inspectors—Brown Hotel, Louisville, Ky., Jan. 27-29. G. M. Miller, 1304 South Seventh St., Louisville.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 28-30. H. M. Northrup, 23 Erie St., Milwaukee.

New Mexico Electrical Association—Albuquerque, N. M., Feb. 16-18. Bernard L. Wiles, Albuquerque Gas & Electric Company, Albuquerque, N. M.

American Institute of Electrical Engineers—New York, Feb. 9-12; St. Louis, April 13-17; Saratoga, N. Y., June 22-26. F. L. Hutchinson, 33 West 39th St., New York.

Wisconsin Chapter of Electrical Inspectors—Pfister Hotel, Milwaukee, Feb. 17-19. A. C. Schultz, Milwaukee.

Dollar Gas in New York Again Held to Be Confiscatory.—For the third time a law passed by the New York State Legislature setting $1 per 1,000 cu.ft. as the maximum rate for gas in the metropolitan district has been found confiscatory by a special master appointed by the United States District Court. The two previous cases have been appealed to the Supreme Court, and the more recent one, which involves the Consolidated Gas Company, is likely also to be taken there.

Hydro-Electric Project on Wabash May Produce 170,000 Hp.—An application for a preliminary permit covering a power project on the Wabash River has been filed with the Federal Power Commission by John A. Schafer of Indianapolis. He desires to construct a dam in the Wabash at Great Rapids and two additional dams in the East Fork of White River. The site is in Dubois and Martin Counties, Indiana, and Wabash County, Illinois. As much as 170,000 hp. can be developed, it is estimated.

New York Edison Company to Move Offices.—After January 1 the general offices of the New York Edison Company, now at 130 East Fifteenth Street, will occupy the fourteenth, fifteenth, sixteenth and eighteenth floors of the new Equitable Life Assurance Society Building at 393 Seventh Avenue. This twenty-six-story building, situated directly opposite the Pennsylvania Railroad Terminal, is supplied with electrical energy for every modern adaptation by the New York Edison Company, motors rated at 3,000 hp. in all and lighting facilities requiring 950 kw. to serve them being installed.

Augusta, Ga., Celebrates Inauguration of "White Way."—A general celebration took place in Augusta, Ga., on December 8, when a new "white way" was inaugurated on Broad Street, the city's main thoroughfare, bringing about, according to a local newspaper, "a flood of brilliancy such as can be boasted by only three other cities in the United States." Included in the program was the free exhibition of a film entitled "The Light of a Race," which depicted the advance of lighting systems from the days of the cave man.

Broad River Power Company Building 110,000-Volt Line.—Work is being pushed on a 110,000-volt steel-tower transmission line which is to connect Columbia and Spartanburg, S. C., with Parr Shoals, where the Broad River Power Company, a Barstow subsidiary, has a hydro-electric plant and is erecting also a 15,000-kw. two-million-dollar steam station. A substation is to be built in Columbia where the energy will be stepped down to 33,000 volts and 13,000 volts. The estimated cost of the transmission line is $1,000,000.

More Mergers Under Way in New York State.—The New York State Gas & Electric Corporation of Ithaca has asked the Public Service Commission to allow it to acquire the Roxbury Light & Power Company, serving unincorporated villages in Delaware County with energy purchased from the Tri-County Light & Power Company, which the New York State Gas & Electric Corporation is seeking to lease. The Central Hudson Gas & Electric Company of Poughkeepsie seeks to purchase the Electric Light Company of New Paltz as well as the Haight system in Stamford, Dutchess County. The Adirondack Power & Light Corporation asks consent to buy the Consolidated Electric Company of Greenwich, Washington County.

Harrisonburg, Va., Retains Municipal Plant.—The Harrisonburg (Va.) City Council has for the second time disapproved of a proposal looking to the purchase and operation of the city's municipal electric system by the Virginia-Western Power Company, which owns steam stations in Ronceverte, W. Va., and in Charlottesville, Clifton Forge and Staunton, Va., as well as several hydro-electric plants. The council voted down a resolution to authorize the company to make an audit and survey of the Harrisonburg system. The municipal plant is said to return a profit of $80,000 annually.

Sheffield Company Is Sold to Alabama Power.—The Sheffield Company of Sheffield, Ala., announced last week that it had disposed of its properties to the Alabama Power Company. The consideration was not named, but was said to be large. The Alabama Power Company was to take possession on December 16. The Sheffield Company owned and operated an electric power plant, an interurban railway and the water plant which supplies Sheffield and Tuscumbia. It also owned a street-lighting system in Sheffield containing more than three thousand lamps.

Lighting Educational Committee Extends Plans.—With the completion of all local contests of the Lighting Educational Committee's home essay competition among school children, a plan has been announced for a supplementary national contest to be open to employees of electric light and power companies and electrical manufacturers and jobbers. The details for this contest for electrical men have not yet been completed, but national prizes are to be offered and the residue of the lighting primers in the possession of the committee will be utilized in order that representatives of electrical companies may have the same instruction in home-lighting requirements that the school children have had.

National Park and San Joaquin Lines Are Interconnected. — Hydro-electric power generated in Yosemite National Park is now distributed to the San Joaquin Valley as the result of a co-operative agreement between the National Park Service and the San Joaquin Light & Power Corporation. The cost of connecting the transmission lines of the two systems was $30,000, including the completion of a substation. J. W. Emmert, chief electrician of the park system, says that the San Joaquin Light & Power Corporation will supply the park with power during emergencies, but that on the whole the latter's plant will dispose of a large surplus to the private concern. This agreement between a national park power system and a private power company is considered unique.

Largest and Smallest X-Ray Tubes. —The largest and smallest commercial Coolidge X-ray tubes are shown in the accompanying illustration. The largest and most powerful is being used in cancer treatment; the smallest is used in the portable X-ray outfit recently developed in the research laboratory of the General Electric Company. The larger is more than one hundred times as powerful as the smaller one. The largest commercial Coolidge tube operates at 250,000 volts and 50 milliamperes, with continuous output. The anode is water-cooled, and the glass bulb is 8 inches in diameter. Operation is in conjunction with a generating outfit consisting essentially of a high-tension transformer, rectifying switch and resistance control. The smallest tube operates at 56,000 volts (maximum) and 10 milliamperes and is mounted in oil. The bulb, 1¾ inches in diameter, is of glass which contains 55 per cent by weight of lead. The tube is only four inches long.

Iowa's New Water-Power Law Takes Effect. — The State Executive Council of Iowa has just issued the first permit for erection of a river dam under the new state law resigned to promote the development of water power. It goes to the Iowa Electric Company of Cedar Rapids for the rehabilitation of a power plant at Oakland Mills, on the Skunk River, which furnishes energy to Fairfield, Stockport and other places. This is one of the earliest power dams in Iowa. Many years ago a grist mill was operated on one side of the river and a woolen mill on the other. About 1910 the dam was taken over for an electric power plant. A new dam is now to be constructed 250 ft. below the old one and 3 ft. higher, flooding the whole property. New buildings will be erected and three times the present power capacity developed.

Northern Ontario Power Company Merger.—Announcement is made that the name of the new consolidated hydro-electric power company in northern Ontario will be the Canada Northern Power Company, Ltd. The company will be capitalized at $7,000,000. This is the consolidation of several companies, including the Great Northern Power Company and the Northern Canada Power Company, referred to in the ELECTRICAL WORLD for December 6, page 1221.

Ten New Local Leagues Organized.—The Society for Electrical Development reports that electrical leagues have recently been organized in Uniontown and Coatesville, Pa.; Glens Falls and Amsterdam, N. Y.; Houghton, Kalamazoo and Jackson, Mich.; Michigan City, Ind., and Waterbury and Meriden, Conn. In some of these cities the organization of the league was an outgrowth of the interest developed in the home-lighting contest. Dozens of other communities the society reports, are keenly interested in developing permanent organizations.

Improving Electric Service in Paris. —The Municipal Commission of Paris reports that the Saint-Ouen generating plant has been equipped with new groups of turbo-alternators rated at 30,000 kw. At the peak demand during the coming winter this station will be able to deliver 240,000 kw., or 25 per cent more than last year. When daylight saving came to an end last fall the peak load at this plant jumped in twenty-four hours from 88,000 kw. to 175,000 kw. New substations will be erected throughout Paris, the commission reports, and a marked improvement in electric service is predicted.

Uncle Sam's Biggest Searchlight.—What is said to be the most powerful electric searchlight in the world, with a normal range of more than 50 miles, has been put in operation on Staten Island, New York. It is part of the equipment of the United States Lighthouse Service and was developed by the government in an effort to produce a light more powerful than any hitherto built. A single electric lamp of approximately five billion candlepower supplies the beam, and this beam is reflected as a brilliant shaft of light by a series of high-power lenses. On a clear night the beacon has been reported as visible in Philadelphia, more than 80 miles away.

Consumers Power Company Acquires Rights on Rifle River.—The Consumers Power Company has purchased the power rights on the Rifle River in Michigan, extending from 2 miles below Sterling, Arenac County, to near West Branch, Ogemaw County. Developments will be undertaken when justified by power demand. Engineers estimate that the energy developed at four proposed dams will be about 12,000 hp. at the maximum and 3,000 hp. at lower water. Work on the four hydro-electric stations on the Tobacco and Tittabawassee Rivers, not far from the Rifle, is progressing rapidly. It is planned to have them all running next year. These will contribute about 50,000,000 kw.-hr. a year, with a possible maximum of about 70,000,000 kw.-hr. and a minimum of not less than 40,000,000 kw.-hr.

Water and Power Act Expenditures Shown.—Expenditures of the California power companies in their fight against the water and power act, defeated in the November election, aggregated $103,656, according to final statements of campaign expenses recently made public. Proponents of the act reported spending $42,012. Rudolph Spreckels, who was an ardent advocate of the act both this year and in 1922, was the heaviest single contributor. Itemized expenditures by the power companies were as follows: Southern California Edison Company, $39,188; Pacific Gas & Electric Company, $46,285; San Joaquin Light & Power Corporation, $6,380; San Diego Consolidated Gas & Electric Company, $5,464; Western States Gas & Electric Company, $2,182; Southern Sierras Power Company, $1,595; Midland Counties Public Service Company, $1,306; Great Western Power Company, $1,252.

New Transmission-Line Map of North Pacific States.—A recent map of the Northwest published by the Pacific Power & Light Company, Portland, Ore., shows the main transmission systems of virtually every company operating in that territory. Each company's system is printed either in red, yellow or brown, with connected or nearby lines of adjacent companies plainly designated by a change of color. No voltages are marked, but, in general, the principal lines of each company, whether 11,000 volts or higher, are shown. In certain instances concerning small isolated systems lines of 6,600 volts are included. The transmission-line data were gathered from the different companies by the engineering department of the Pacific Power & Light Company, while the base map was prepared under the personal supervision of Lewis A. McArthur, vice-president and general manager, who is recognized as an authority on the geography of the Northwest. It is said that this base map is the most accurate map of the Pacific Northwest, in drainage, land lines and names, that has ever been published.

What? Franklin's Kite a Myth?—A declaration made a week ago in the course of a Boston address by Prof. Alexander McAdie, director of the Blue Hill Observatory, that Benjamin Franklin's famous kite-flying exploit during a lightning storm was a myth and, had it ever taken place, would have been followed by a coroner's inquest over the philosopher's remains roused the International Benjamin Franklin Society to protest. John Clyde Oswald, president of the society, and J. Henry Smythe, Jr., historian, declared there was ample proof of the veracity of the story. "Franklin's correspondence with Peter Collinson of London tells how to make the experiment," Mr. Smythe said. "His autobiography tells of the success of a similar one made by him in Philadelphia. Five colleges and the Royal Society rewarded him after careful investigation." Replying to Professor McAdie's assertion that the shock would have killed Franklin, Mr. Smythe said records made it plain that Franklin was guarded by a non-conductor of electricity.

Cumberland, Md., Tied Into Potomac Edison System.—The Potomac Edison Company, a subsidiary of the American Water Works & Electric Company, has just completed the high-tension transmission line from its new generating plant at Williamsport, on the Potomac River, to Cumberland, Md., a distance of more than 50 miles. This improvement, which has cost in excess of $1,000,000, will give Cumberland and its environs sufficient reliable power to meet the rapidly growing demand of that industrial center for years to come. This and the contemplated interconnections to the west with the hydro-electric developments of West Virginia and to the northwest with the mine-mouth generating stations of Pennsylvania will make the Potomac Edison System an important link in the contemplated "electrical highway" stretching from Cleveland to tidewater. Hagerstown, Frederick and other cities in Maryland, in addition to Cumberland, are in the company's territory, which takes in also parts of Virginia, West Virginia and Pennsylvania.

American Engineering Council to Press Administrative Reorganization at Washington. — Following the recent declaration of Secretary Work in favor of the creation of a Bureau of Public Works within the Department of the Interior, the American Engineering Council expresses dissatisfaction with half-way measures and determination to press a broad plan of federal administrative reform. More than fifty thousand professional engineers, representing thirty national and local engineering societies in all parts of the country, will participate in the movement, which, it is also announced, will be discussed at a national forum to be held in connection with the annual meeting of the council in Washington on January 16 and 17. The administrative board of the council has instructed the committee on government reorganization as it relates to engineering matters "to adopt a policy of aggressively working for the complete project of the Department of Public Works as originally outlined in the McCormick bill finally developed in the Brown plan."

Men of the Industry

F. C. Pratt Succeeds Emmons at Schenectady

Francis C. Pratt, vice-president of the General Electric Company in charge of engineering, has been appointed vice-president in charge of manufacturing to fill the vacancy caused by the recent resignation of George E. Emmons. Mr. Pratt, who also will be chairman of the manufacturing committee, will remain in charge of engineering, his new title being vice-president in charge of engineering and manufacturing.

H. F. T. Erben, who has been identified with the General Electric Company since its early beginnings at Schenectady, serving as engineer, assistant manager and manager of the Schenectady Works, and for almost two years as vice-chairman of the manufacturing committee, has been named assistant vice-president of the company under Mr. Pratt.

James Cleary, formerly manager of the Philadelphia office of the Combustion Engineering Corporation, will assume management of the Detroit and Cleveland territories with headquarters in Detroit.

Peter William Sothman, well known to the engineering profession in the United States and Canada, has returned to this country after an absence of five years to affiliate himself with M. H. Avram & Company, engineers of New York. Mr. Sothman was formerly chief engineer of the Hydro-Electric Power Commission of Ontario, and during his period of service he supervised and completed in part the municipal distributing systems, including street lighting, water pumping and sewage distribution plants, connected by the Niagara system, consisting of many small municipal plants. Subsequently he opened consulting engineering offices in Toronto and New York, numbering among his clients many of the large electric light and power companies in the East and in Canada.

Joseph T. Goodyear, formerly connected with the Oakland Motor Car Company, has joined the Robbins & Myers Company of Springfield, Ohio, as technical assistant to the president, in charge of all equipment.

C. E. Skinner, assistant director of engineering of the Westinghouse Electric & Manufacturing Company, was elected chairman of the American Engineering Standards Committee at a recent meeting in New York City. Mr. Skinner, well known throughout the electrical world for his engineering accomplishments and his association with many engineering organizations, was a member of the engineering council organized primarily for war work which has since become the American Engineering Council. He has been manager and vice-president of the American Institute of Electrical Engineers and is one of the two representatives of that body on the board of management of the World's Congress of Engineers, which will be held in Philadelphia in 1926.

Theodore D. Moore, who resigned last summer as manager of the Corry (Pa.) office of the Venango Public Service Company after a seven-year period of service, is now associated with the Toms River (N. J.) Electric Company as new-business representative. The Toms River utility is controlled by the Jersey Central Power & Light Corporation, which is under the management of the General Engineering & Management Corporation, New York. Mr. Moore was connected with the New York corporation before going to Corry.

W. E. McFadden, manager of the Norfolk district of the Nebraska Gas & Electric Company, has been transferred to the company's Omaha office to be special contract agent.

Joseph Bettendorf, formerly connected with the distribution department of the Consumers Power Company at Saginaw, Mich., has been promoted to the position of local manager at Royal Oak.

John J. Carty, vice-president of the American Telephone & Telegraph Company, has been made chairman of an advisory board on research and development policies and also chairman of the board of directors of the recently organized Bell Telephone Laboratories, Inc.

Frank B. Jewett, vice-president of the Western Electric Company, has been elected vice-president of the American Telephone & Telegraph Company and president of the Bell Telephone Laboratories, Inc., recently organized by the American Telephone & Telegraph Company to take over the laboratory and research work formerly carried on by its affiliated company the Western Electric. Mr. Jewett, who is a past-president of the American Institute of Electrical Engineers, will be in direct charge of the research and development department of the American Telephone & Telegraph Company.

A. K. Ellis, general manager of the Wisconsin Traction, Light, Heat & Power Company, Appleton, Wis., has been named as vice-president in charge of operations of the Peninsular Power Company, recently acquired by the North American Company. Mr. Ellis will retain his connection with the Appleton properties.

John H. Trumbull, president of the Trumbull Electric Manufacturing Company, Plainville, Conn., and recently elected Lieutenant-Governor of Connecticut, will become Governor of the state upon the resignation of Governor-elect Hiram Bingham, who has just been elected to the United States Senate. Mr. Trumbull has been active in political affairs in Connecticut as state senator, president of the State Senate and acting Governor in the absence of the Governor.

George H. Whitefield has been appointed Director of Public Utilities of Richmond, Va., to succeed E. W. Grafford, who has occupied that position since 1919. Mr. Whitefield is well known in Richmond, having served as engineer for the Virginia Railway & Power Company at the time of its reorganization in 1902. He was serving as engineer of the New Jersey Department of Institutions and Agencies when he received his present appointment.

R. E. Baird, who recently resigned as manager of the Oklahoma Gas & Electric Company at Pauls Valley, has been appointed manager of the Jackson properties of the Mississippi Power & Light Company. Mr. Baird served as manager of the Le Flore County Gas & Electric Company at Poteau before the property was taken over by the Oklahoma Gas & Electric Company.

S. B. Way, vice-president and general manager of the Milwaukee Electric Railway & Light Company, has been named president of the Peninsular Power Company, recently acquired by the North American Company. The company serves a number of communities in Wisconsin and northern Michigan, including Crystal Falls, Iron Mountain, Iron River and numerous other communities and mining industries.

C. F. Uhden, the chief engineer retained by the city of Seattle on the Skagit hydro-electric development, has tendered his resignation to Mayor Edwin J. Brown, the work for which he was employed, the first step in the development, having been completed under his direction.

H. E. Tobey New Commercial Manager in Vincennes

Harry E. Tobey, recently promoted to the position of manager of the commercial departments of the Indiana Power Company, the Consumers Power Company and the Knox & Sullivan County Power Company, with headquarters at Vincennes, Ind., has been

H. E. TOBEY

identified with the electrical industry since he finished his college course. He was assistant manager of the Connersville (Ind.) district of the Interstate Public Service Company from January, 1922, until this appointment. In 1920 and 1921 he was sales manager of the Hydro-Electric Light & Power Company of Connersville, this utility having been purchased by the Interstate Public Service Company in the fall of 1921. Previous to 1920 he was actively engaged in electrical maintenance and inspection for the State of Indiana at Indianapolis and with the Stearns Coal Company and the Kentucky & Tennessee Railway Company at Stearns, Ky. The companies whose commercial departments Mr. Tobey has been selected to head were recently purchased by the Interstate Public Service Company.

F. B. Culley of North Augusta has been elected to the office of general manager of the Carolina Light & Power Company, Aiken, S. C., which has recently been taken over by the J. G. White Management Corporation, New York. Mr. Culley is also a member of the company's board of directors.

Obituary

Claire P. Upson, sales manager of the States Company, Hartford, Conn., died on Saturday, December 6.

Paul C. Kearcher, formerly manager of the Shenango Valley Light & Power Company, Huron, Pa., died at his home in Youngstown, Ohio, November 22, following a short illness. Mr. Kearcher was fifty-two years of age.

John J. Doyle, chief engineer of the New York & Queens Electric Light & Power Company for the last twenty-five years, died December 16 in St. Luke's Hospital, New York, following an operation performed there two months ago. Mr. Doyle was sixty-one years of age.

Franc W. Altman, who for many years was active in public utility circles in Iowa, his native state, died November 20 at his residence in Dubuque as the result of cardiac apoplexy. Mr. Altman was president of the Union Electric Company, now the Dubuque Electric Company, and organized and promoted the Eastern Iowa Electric Company, serving as its president from the time it was incorporated in 1913 until 1922, when he disposed of his holdings to other interests.

Hubert S. Wynkoop, chief engineer of the electrical inspection division of the Department of Water Supply, Gas and Electricity, New York City, died December 13 at his residence in Queens Village, Long Island, in his fifty-seventh year. Mr. Wynkoop had been associated with the electrical inspection service of the city of New York for the past thirty years. After being graduated from Stevens Institute, he worked as an engineer for the Great Northern Railway and for the General Electric Company in the South and West, subsequently returning East. Mr. Wynkoop became well known through his identification with the National Electrical Code at the time of its preparation and through his activities as a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the Brooklyn Engineers' Club.

Walter E. Harrington, consulting engineer and public utilities expert, died suddenly December 12 in his fifty-eighth year. Mr. Harrington was formerly operating manager of J. G. White & Company and at the time of his death was consulting engineer for J. R. Bridgeford & Company, New York. A native of Wilkes-Barre, Pa., and a graduate of the University of Pennsylvania, Mr. Harrington specialized in public utility work, managing electrical properties for more than twenty years. He spent a year in London and upon his return to the United States in 1914 engaged in consulting engineering practice for four years. It was in 1918 that he became affiliated with Bridgeford & Company. Mr. Harrington was a member of the American Institute of Electrical Engineers and the Engineers' Club, a past-president of the electrical section of the Franklin Institute and a member of the American Street Railway Association.

Commission Rulings

Percentage Rate for Distributing Companies Condemned.—Declaring that the purchase of electrical energy on the basis of a percentage of the gross revenues received from customers is conducive to waste and to the offering of flat-rate service at extremely low rates, the Oregon Public Service Commission condemned this arrangement, which subsisted between the Idaho Power Company and the Vale Electric Company. The Idaho company contended that the Vale company, which owns the transmission line from the Idaho company's system to Vale, should purchase the energy at the regular power rate, but the commission, saying that such a change would place the distributing company, and indirectly the consumers it serves, under the handicap of bearing transmission lines and losses, prescribed instead rates at a 35 per cent discount from the corresponding schedule applied to regular power customers.

Rates for Special Business Which Does Not Affect Peak Demand.—Authorizing new heating and cooking schedules for the municipal plant of the city of Colby, the Wisconsin Railroad Commission said: "Cooking and heating rates, as well as power rates, are not based on the average cost. The high average cost is due primarily to the fact that the greater portion of the energy used at Colby is for lighting purposes and the high demand is the lighting demand. Experience in other communities indicates that undoubtedly a large motor and heating load could be added in Colby without materially affecting the demand component of the bill for service. Further, the excess energy purchased over and above what is now being purchased will cost the utility 2½ cents per kilowatt-hour. Any heating, cooking or power business added, therefore, which does not affect the peak demand would be entitled to a rate based on the costs of serving that class of business, and such a rate might very well be less than the average cost of energy."

Necessity of Standby Plant to Reliable Operation of Municipal Hydro Property.—As already reported in the news columns of the ELECTRICAL WORLD, the Colorado Supreme Court has overruled the Public Service Commission of the state in the matter of building a municipal hydro-electric plant at Loveland. The commission had refused to sanction this enterprise, but the city went ahead with its plans, defying the commission, which sought an injunction to enforce its ruling. The commission's opposition was based both on the contention that the plant would compete with the existing installation of the Public Service Company of Colorado and on its alleged inadequacy to the needs of the city. The commission particularly condemned the omission of any plan for a standby steam plant, saying on this point, as reported in "Public Utilities Reports" for November 20: "In the face of the conflicting conclusions reached by different witnesses as to water supply and storage, the commission, with its staff, might have conducted an independent investigation of these matters; but it is so obvious that, regardless of the exact hydro-electric capacity of the river at this point which good conservative engineering practice would approve, the plans for this project show too little study of these fundamental factors, and, if built, its ability to carry the total probable demands, even during its first year of operation, is so close to the danger line of impossibility, that the commission cannot fairly approve this feature of the plans. Certain factors as pointed out which should have been given serious consideration have been disregarded or belittled. In view of the above it appears imperative that a sufficient standby plant, or provision for standby service, should form a part of the original plans. A standby is entirely omitted from the plans which the commission is asked to approve. In that respect the commission decides the plans are incomplete. It cannot consider that the small auxiliary plant proposed for carrying the peaks as the business grows in later years could fulfill the standby requirements. It would be entirely inadequate for the purpose under consideration. The only evidence submitted as to a suitable standby plant originated from complainant's witnesses. This proposed standby plant must be considered by the commission as an essential part of the proposed project, especially since this testimony was not seriously challenged by defendants."

Advantages of Consolidation of Electric Companies Serving Same Field.—Authorizing the consolidation of the competing electric light plants in Lincoln—one a Continental Gas & Electric subsidiary and the other operated by the Lincoln Traction Company—the Nebraska State Railway Commission said: "From the public point of view this consolidation is advisable if it will result in stronger financial connections enabling the owners to bring about lessened costs by modern equipment. Applicant company in the electrical field has been developing rapidly in Nebraska and has shown itself thus far able to command the necessary finances for development. Nothing indicates that it cannot continue in this favorable position. Consolidation of these utilities competing in the electric field should definitely result as shown by the record, in (a) consolidation of generating plant in due course of time and reduced out-of-pocket cost of production of electricity, (b) gradual elimination of duplicate distribution property at present existing and thereby improvement in appearance of the streets and alleys of the city, (c) gradual elimination of duplicate maintenance costs of present equipment and elimination of certain duplicate labor costs of production, (d) prevention of unnecessary future duplication of extensions into common territory, (e) potential reduction of overhead costs, and (f) potential reduction in charges to the public."

Recent Court Decisions

Law Abolishing Service Charge May Cause Confiscation and Thereby Become Unconstitutional.—In confirming, with modifications, the report of a special master in New York & Queens Gas Company vs. Prendergast et all., the United States District Court for the Southern District of New York said that although it is within the power of a legislature to prohibit the making of a "service charge" by a public utility company, yet when, taken in connection with another statute or an order of a public service commission, its abolition so reduces the entire permissible charge that it becomes confiscatory, then the law becomes unconstitutional. (1(2d) Fed. 351.)*

Right to Refuse Service to Customer Refusing to Obey Non-Discriminatory Rule Upheld. — The Vermont Hydro-Electric Corporation was sued by one Hawkins because of its refusal to connect his dwelling with its distributing system until he had installed the kind of entrance switch box and ground wires required by the company's rules. The Vermont Supreme Court vacated an order of the Public Service Commission of the state directing the company to connect its system with plaintiff's premises and serve him. The court held that the rule did not discriminate against the plaintiff and that the statutes by implication permitted a public service corporation distributing electrical energy to adopt reasonable and lawful regulations, without unjust discrimination, for conduct of its business, binding on its patrons and enforcible against them, even to the extent of refusing service to those who refuse to comply therewith. (126 At. 517.)

State Water Right Laws and Their Extraterritorial Protection.—Although the laws of a state through which a stream flows respecting water rights cannot limit or affect the rights of citizens of another state through which the stream flows in the waters of that stream, the United States District Court of Colorado, while asserting (in Finney, County Water Users' Association vs. Graham Ditch Company) this principle, held also that a suit by a citizen of one state in a federal court to protect his right to the use of the waters of an interstate stream, in accordance with the laws of the state, from unlawful interference by citizens of another state, being one to redress violation of rights secured to complainant by the Constitution and laws of the United States, jurisdiction of such court cannot be defeated on the theory that, because the laws of the two states respecting water rights are different, complainant must wait for redress until his state has sued the other state to determine a proper division of water. (1 Fed. (2d) 650.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Incomplete Specifications Make Trouble

How Insufficient Information Hampers the Manufacturer and Delays Deliveries—What Users Can Do to Overcome This Trouble

By L. G. Buehler
Chief Engineer William Ganschow Company, Chicago

THERE are certain classes of engineering equipment in such common use that purchasers are apt to be lax in their specifications when making purchases. This is especially true of power-transmission machinery. But while the more common items, such as hangers, bearings, pillow blocks, pulleys, etc., may be correctly specified by stating the material and two or three of the chief dimensions, there are other devices which involve more engineering thought in their construction and application and for which very complete specifications must be received in order that proper equipment may be furnished.

The primary result of incomplete specification is naturally a greater time taken for delivery. It is clearly seen that unless a purchaser includes every descriptive detail of the equipment he desires at the time of the first writing, much time is lost by a flow of letters straightening out the details as to what the purchaser exactly wants. Manufacturers unfortunately are not mind readers and cannot be supposed to know all the usage details of their equipment which a purchaser wants. No manufacturer cares to go ahead and design a new piece of equipment upon being furnished only with meager details of specifications unless he is familiar enough with the purchaser's problems to know that his time, labor and materials will not be wasted when the finished product is completed.

A Pertinent Example

An illustration of the kind of data that are required may be found in the building of speed reducers for conveyors, stokers, machine tools or motor drive. Here certain fixed constants must be absolutely known before the shipment can be made. So important are these constants that we have included them in a prominent place in our catalog so that our purchasers must refer to them when requesting information as to price or new designs. These factors are five in number, namely, (1) the horsepower, speed of motor and ratio wanted or the speed of the driven shaft; (2) class of work for which the speed reducer will be used, or how the energy will be transferred either from a motor pulley or sprocket; (3) whether it is continuous or intermittent service; (4) information as to the type of load, whether it is uniform or full of peaks, or whether it is subject to intense shock; (5) whether flexible couplings are desired — this is for extra-long shafts requiring larger outboard bearings. Naturally, if this information is not furnished completely in the purchaser's first letter, much time is lost in corresponding, if the purchaser desires immediate shipment.

There is also another matter of specification in which the purchaser can save considerable money by a little careful consideration. The speed transformer is primarily designed to do away with special motor design, for it adapts the modern high-speed alternating-current motor to low-speed use at a cost which is considerably less than the cost of special low-speed motor design. We have found in a number of cases that purchasers of speed-reduction equipment have specified the use of special motors for speed-transformer units when, with the expenditure of a few more dollars in procuring a high reduction ratio, a standard motor unit could be used. A little careful attention to the specifications of motors will save not only the extra cost of special design but considerable time in procuring special units.

Up to the Buyer

The purchaser who furnishes very little information expects, of course, complete detailed data from the manufacturer. One organization furnished three sketches recently showing the location of a speed reducer These sketches provided only one specification—that of speed. There was no size of motor mentioned, and yet we were asked to furnish a speed reducer to take care of that manufacturer's load. It merely meant further correspondence to determine the other factors. In other cases we have had inquiries where purchasers requested that speed reducers be furnished for equipment rated at over 75 hp. with high-speed large-gear reduction. Now, it is not economically feasible nor efficient to lower speeds of such a large-capacity motor by speed reducers, because of troubles arising from speed and friction.

Delay Can Be Prevented

These are just instances where purchasers hamper the manufacturers by not supplying enough information as to their requirements. Although we find that 75 per cent of our inquiries do furnish enough information for an immediate shipment, the delay and disappointment caused by the remaining 25 per cent is sufficient to present a problem to users and to justify their attention to what they can do to assist their manufacturers when in hurried need of equipment. Should more of these inquiries contain complete information as to specification for either spot delivery or new-designed equipment, manufacturers would be in a better position to improve this service to their users. It is up to the user himself to furnish this complete information if he wants good service.

Much of Europe's Business Obtainable by America

AMERICA will probably obtain a large share of Europe's electrical business because this country is more advanced in electrical development than Europe and has all the advantages that result from mass production, according to F. M. Rogers of London, European manager of the Westinghouse Electric International Company, who is at present in New York on a business trip.

"If the Dawes plan stabilizes Euro-

pean exchanges, as there is reason to believe that it eventually will, American exporters will be greatly benefited," Mr. Rogers says. "Under present conditions, if goods are sold to buyers of many European nations, so wide a variation may take place in the exchange rates before deliveries can be made that the transaction will become unprofitable to either the buyers or the sellers. This possibility naturally retards business. With the solution of the problem of German reparations, however, this trouble will be overcome and normal commercial relations will be re-established.

"Germany is showing evident indications of a determination to recover her position as the leading industrial nation of Europe. It is no empty phrase to say she is working hard. The directors of many of her companies work sixteen hours a day. Great Britain appears to have overcome her post-war antagonism to Germany and is cordial in her attitude toward her former enemy. She also is making every endeavor to get her financial, commercial and industrial affairs into sound condition, and if she plans skillfully will be able to challenge Germany's leadership. France," in Mr. Rogers' opinion, "is still dependent upon German reparations, and until she obtains her expected payments she will be unable to import American equipment extensively."

Distributing "Non-Repeating" Equipment

What a Manufacturer Faces in Obtaining Proper Sales Representation—Outcome of Experience with Electric Grinders

By P. J. Bodine
General Manager Bodine Electric Company, Chicago

THE average user of electrical equipment naturally feels that he has no direct relation to the problem of the manufacturer in obtaining proper and economical distribution of an article which does not enjoy a repeating business. When considered collectively, however, the case presents more serious phases than might be considered possible upon first thought. While this situation might not have any direct bearing on an individual, its seriousness when it affects a group of buyers is apparent. This article is written with the view in mind that the jobbers and consumers of the electrical triangle might profit by becoming more acquainted with this problem of the other angle—the manufacturer.

In the first place, a manufacturer producing an article which, when once installed, is rarely replaced faces considerable sluggishness from jobbers and distributors in making sales. Such an attitude of mind is natural. These men are in a business where success lies primarily in the amount of turnover of equipment. To keep their own business going it is not difficult to see that they must spend their major time selling equipment which furnishes enough return on sufficient turnover. Therefore, through a simple method of elimination occasioned by purely economic reasons, the sale of equipment which does not require continual replacement naturally suffers. This is not said in any deprecatory mood against jobbers and distributors of such equipment. It is merely brought out to prove the point that manufacturers of this type of equipment have been forced to find other means of pushing their sales. Undoubtedly, if these manufacturers were in the same position as the jobbers and distributors they too would be doing exactly the same thing—pushing that equipment which affords good turnover so that their business might be run profitably.

Special Agents Preferable

Thus, with aggressive sales promotion lacking among regular jobbers and distributors, the manufacturers of this equipment have turned to other means of obtaining distribution. One of the best ways found has been through the selection of manufacturers' agents in various centers of industry. Where products were of a decidedly technical nature it has been found that engineering talent as well as sales ability is absolutely required in pushing the sale of this "non-repeating" equipment. By this means a manufacturer can hold a fairly good control over an agent, if sufficient sales are not forthcoming from that territory. In territories where the manufacturer finds his agent not very enthusiastic regarding the equipment, it is much easier to dispense with this agent and find another one than it is to write the name of a jobber or distributor off the company's books. The control a manufacturer has over his agent is much stronger since an agent really represents the manufacturer in that territory. This is a different situation, of course, from that wherein a jobber merely received orders and did not aggressively promote business.

A Concrete Example

As a concrete example of this type of "non-repeating" equipment mention might be made of this company's experience with the distribution of electric grinders. This is a tool designed for any machine shop having production problems with cutting tools. The grinder is of material aid in increasing production where machine shops employ fifteen men or more. By using a bench electric grinder it is not necessary for a machinist to grind tools on grinding equipment used for regular production, which is often the case in small machine shops.

The first method of distributing these electric grinders was through machinery dealers. But it was found that because of the difference in price of this grinder and large-sized, expensive machinery these machinery agents did not actively push them. There was more money in selling machine tools and a larger percentage of income. Stepping away from this method of distribution, our company sought the service of jobbers and distributors, but the same situation was discovered here. Jobbers and distributors concentrate their main efforts on lines which are quick-moving. Unless a jobber's salesman was given a wide enough territory, he could not make sufficient sales to pay expenses and give the requisite income on his capital outlay. This was due to the type of the product; for one machine-tool grinder would last practically a life-time in every job installed.

As an outcome of these two selling programs, the company decided to use manufacturers' representatives in various centers of industry, and this method up to date has been working very successfully. The company has been careful in picking the right types of manufacturers' agents and believes that it has found the proper method in the distribution of equipment which is "non-repeating."

Business Conditions

SALES in the electrical industry are in good volume, and in one instance it was reported that the budget for one territory was exceeded. A manufacturer of instruments states this to be the case in New England despite the textile situation. Industry has been purchasing much more extensively. A steel company is expected to place orders soon for more than $600,000 worth of switchboard and control equipment in connection with orders recently placed for plant electrification. A manufacturer who has just returned from a trip through the Middle West states that he found on talking with several customers that many plans are now definitely going forward and that business is generally much better—a feeling that was found to be unanimous.

The railroads have been very active in purchasing equipment and rails. The New York Central placed an order with the General Electric Company for nine new electric locomotives. Steel-mill operations have increased steadily and in the last week are said to have been approximately 80 per cent of capacity. For the first time in many months several mills are behind in bar deliveries.

In New England lighting equipment sales—industrial, commercial and residential—are in good volume, and better business continues. There have been more inquiries for quotations on large jobs in the New York district than for a long time, and good sales are generally reported. In the Southeast sales are quiet, but some good orders were received from central stations for poles and pole-line hardware. Business is still improving in the Middle West, and there has been an active demand for cable. On the Pacific Coast building continues very active.

Heavy Sales of Non-Ferrous Metals Send Prices Up

AN exceptional demand for copper, zinc and lead prevailed during the last week, and considerably higher prices have been realized for these metals. For the five selling days ended Tuesday sales of 59,000,000 lb. of copper for domestic use were reported by seven sellers, and about 2,000,000 lb. additional was sold early on Wednesday morning. Practically all of this was for first quarter delivery. The Western Electric Company and Eastern brass, wire and sheet mills were the principal buyers. Nearly all sales on Wednesday were made at 14⅝ cents. For the time being domestic sales have overshadowed foreign business, although this has been quite satisfactory. The American Brass Company made two revisions in its list prices during the week.

The American Smelting & Refining Company raised its official contract price for lead to 9.25 cents. There was a demand greater than the available metal. Some dealers with small quantities received as high as 10 cents, but only a small amont was sold at this price. There are several indications that substitutes for lead will be used should present prices persist. The foreign market is even stronger, though part of this is believed to be speculative.

A rapid advance in zinc prices has been the result of the very large sales of lead to galvanizers and brass mills. A good export business was done early in the week. Moderate tonnages of tin were bought by consumers, mostly for early shipment and whenever there were indications of price concessions.

NEW YORK METAL MARKET PRICES

	Dec. 10, 1924 Cents per Pound	Dec. 17, 1924 Cents per Pound
Copper, electrolytic	14½	14⅝
Lead, Am. S. & R. price	8.90	9¼
Antimony	14¼	14¼
Nickel, ingot	29½	29½
Zinc, spot	7.40	7.80
Tin, Straits	55	55⅜
Aluminum, 98 to 99 per cent	28	28

More Large Inquiries and Better Sales in the New York District

"WE ARE receiving more inquiries for quotations on big jobs this month than for a long time," says a large electrical manufacturer, "and there is every indication that conditions are steadily improving." Very good business is being reported by several companies, and a manufacturer of instruments says that industry is buying much more extensively than in the past. Not many large orders are being booked for cable, but the sales of a large company are said to be good as there is a steady demand for the smaller sizes of wire. One wire company placed an order this week for about $10,000 worth of testing equipment to take care of the additional testing required by the new specifications of the Association of Edison Illuminating Companies. Other wire manufacturers have purchased similar equipment, but several orders are still to be placed.

Sales of motors are showing a steady gain, and there appears to be a greater tendency toward the use of motor-driven apparatus. One company reports that so far December sales are ahead of those for the same period in November.

Value of Electrical Exports for October, 1924, Compared with Corresponding Month in 1923

(Issued by Bureau of Foreign and Domestic Commerce)

	October, 1923	October, 1924
Generators:		
Direct-current:		
Under 500 kw	$71,078	$133,622
500 kw. and over	41,406	67,056
Alternating-current:		
Under 2,000 kva	5,295	10,356
2,000 kva. and over	111,980	172,400
Steam turbine-generator sets	*	16,768
Accessories and parts for generators	166,755	83,162
Self-contained lighting outfits	56,719	72,508
Batteries:		
Flashlight	*	65,819
Other primary	99,654	82,572
Storage	196,342	225,418
Power transformers	199,987	224,389
Other Transformers	63,003	121,979
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	57,801	90,548
Switchboard panels, except telephone	78,185	128,584
Switches and circuit breakers over 10 amp	185,345	144,066
Fuses and fuse blocks	38,129	18,907
Watt-hour and other measuring meters	39,099	52,146
Volt, watt and ampere meters and other recording, indicating and testing apparatus	97,180	122,766
Lightning arresters, choke coils reactors and other protective devices	47,233	75,367
Motors under 1 hp	117,505	126,969
Stationary motors:		
1 to 200 hp	334,899	183,279
Over 200 hp	86,740	31,897
Railway motors	11,500	90,972
Electric locomotives:		
Railway	*	34,750
Mining and industrial	18,126	26,716
Other motors	12,750	†
Starting and controlling equipment:		
Industrial motors	*	110,363
Electric railway and vehicle	*	10,768
Rheostats, controllers and other starting and controlling equipment	131,963	†
Accessories and parts for motors	173,001	187,548
Electric fans	62,201	31,143
Electric lamps:		
Incandescent:		
Carbon-filament	3,968	4,571
Metal-filament	118,053	103,236
Other electric lamps	19,723	30,515
Flashlights	36,479	67,463
Searchlights and projectors	19,839	26,576
Motor-driven household devices	41,707	79,432
Domestic heating and cooking devices	88,915	106,283
Industrial electric furnaces and ovens	12,019	19,450
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries	56,257	74,551
Radio and wireless apparatus	270,061	769,249
Telegraph apparatus	19,205	35,604
Telephone apparatus:		
Magneto telephones	45,855	32,089
Other telephones	23,739	23,656
Magneto switchboards	25,402	987
Other telephone switchboards	37,154	43,875
Other telephone equipment	*	172,881
Railway signals, switches and attachments	84,898	52,982
Bells, buzzers, annunciators and alarms	8,011	15,142
Spark plugs, magnetos and other ignition apparatus	124,975	164,167
Insulating material	123,978	146,064
Sockets, receptacles and lighting switches	93,424	110,746
Other wiring supplies and fixtures	160,648	†
Electric lighting fixtures, interior and street	*	73,586
Other wiring supplies and line material	*	94,747
Other electrical apparatus, not elsewhere specified	894,031	728,297
Metal conduit, outlet and switch boxes	42,190	64,337
Globes and shades for lighting fixtures	51,775	37,799
Electrical glassware, except for lighting	13,238	15,672
Electrical porcelain	215,842	117,581
Electrical carbons, carbon brushes, electrodes	226,697	203,731
Insulated wire and cable (iron and steel)	50,324	16,461
Other manufactures of aluminum	110,563	49,457
Copper:		
Bare wire	207,178	192,306
Insulated wires and cables	274,214	446,841
Total electrical machinery and apparatus and supplies	$6,004,238	$6,863,172

* Not separately stated prior to January 1, 1924. † Discontinued beginning January 1, 1924.

Sales Quiet in Southeast—Good Demand for Safety Switches

SALES in this section are reported as quiet, most of the activities in this line consisting of following up business that is expected to materialize after January 1. Building contracts awarded in nine Southeastern states for November amounted to $38,316,000, and while this is a considerable drop from October contracts, it represents a 30 per cent increase over November, 1923. As a result of this electrical construction materials continue to move satisfactorily. Good orders are reported from central-station companies for poles and pole-line hardware, but no orders of note have been received lately. Farm-lighting-outfit sales are on the increase, but business in this line has not been so satisfactory as the agricultural conditions seemed to indicate earlier in the fall.

A good business is being transacted in holiday specialties, one jobber reporting a sell-out, but dealers are disappointed over business to date. Lamp sales are good and another prominent jobber reports that the value of his sales is even ahead of last year's despite price reductions. Safety switches are selling well. A manufacturer's representative states that there is an excellent industrial safety-switch demand, particularly from the iron and steel districts of Alabama.

Cable and Copper Products in Demand in Middle West

BUSINESS is still improving in the Middle West. Central-station purchases have increased materially and every indication points toward a favorable showing of the year-end sales. There has been an extremely active demand for cable—many manufacturers having reported the receipt of several large orders. The upward trend of the copper market has brought about an appreciable call for copper products, particularly for busbars. Many specifications were received by manufacturers in the last week, one of which was for about 150,000 lb. of copper to be delivered during the first quarter of 1925. Central-station construction has fallen off somewhat, possibly owing to the colder weather, but maintenance purchases have kept up well. There was an active demand for cross-arms and a good call for poles. One manufacturer of meters received an order from a central station for 210 indicating ammeters.

Jobbers enjoyed a very good week and reported good sales of diversified commodities. The slogan "Give something electrical" apparently is having a very marked effect upon the buying public, as the sales of electrical appliances have been exceptionally good. The contemplated construction of a thirty-million-dollar group of buildings near the Michigan Avenue bridge, Chicago, was announced this week. Covering a 5-acre tract, there will be under one roof a convention hall seating 20,000, a large hotel, a huge office building and extensive exposition floors. The plans for making these buildings the center of Middle Western agricultural circles came out of resolutions adopted by the five hundred delegates to the recent American Farm Bureau Federation convention.

Lighting Business Booms in the New England District

SALES of lighting equipment are hitting a fast stride in the New England district this week. Residential fixtures are moving in great volume and much commercial work is under way. Industrial betterment programs are active, institutional purchases are on a good scale, and ornamental street-lighting installations are progressing rapidly. On Monday a metal-working plant in Boston signed a contract for 140 industrial fixtures for 200-watt to 300-watt units, and one jobber reported that his total fixture sales this year will exceed $750,000. Another jobber is running 25 per cent above last year on total sales, and even the smaller houses report better business. Bids were in hand this week for several thousand feet of different sizes of rigid conduit for a southern New England power plant, and a number of state institutions are seasonally buying wiring supplies.

Retail trade is very active, appliance sales running well ahead of a year ago in many cases. One central-station group is gaining from 10 to 15 per cent a week in appliance sales. Radio business is excellent, and one jobber shipped 1,000 sets and 350 loud speakers to the trade last week. Central-station buying is quieter, and collections are slightly better.

Building Construction Continues Active on the Pacific Coast

BUILDING on the Pacific Coast continues in large volume. San Francisco is particularly active in this respect, and the showing for this year will probably surpass the previous high record of 1907. The value of November permits were: Los Angeles, $9,754,196; San Francisco, $6,358,729, and Oakland, $2,104,741. November, 1923, values were: Los Angeles, $13,512,042; San Francisco, $3,850,265, and Oakland, $2,336,472. The recent purchase of a controlling interest in the San Joaquin Light & Power Company by the Western Power Cororation is expected to shift the purchasing from Los Angeles to San Francisco.

The United States government will soon build a warehouse at San Francisco for the storage of electrical and other supplies for the 1,200 federal buildings west of the Rockies. Heretofore such supplies have had to be delivered in New York and local companies have been unable to compete with Eastern firms. A cold snap has produced many radiator sales, but stocks are still high. The new pole-line hardware plant in Emeryville, Cal., will probably be ready by January 1. A big year for such material is foreseen, the prediction being based on present programs as well as those that were postponed during the year because of the drought. Snow followed by extremely cold weather in the Puget Sound district has almost paralyzed construction activities and seriously interfered with business.

Activities of the Trade

Weston Electric Instrument Reorganizes

The Weston Electric Instrument Company, Newark, has been reorganized and will henceforth be known as the Weston Electrical Instrument Corporation. The offering of stock of the company is described on page 1342 of this issue.

The company announces that its policy and aims will remain the same as in the past and there has been no change in management. Edward F. Weston is president of the company, Dr. Edward Weston chairman of the board and Caxton Brown secretary and sales manager.

Burndy Engineering Appoints a Pacific Coast Representative

The Burndy Engineering Company, Inc., 10 East Forty-third Street, New York, manufacturer of "Burndy" T-connectors and other high-tension bus fittings, has appointed Charles A. Etem, 3804 Third Avenue, Los Angeles, as representative for the Los Angeles territory. The Burndy company announces that it is supplying its connectors for the new generating station of the Sioux City Gas & Electric Company at Sioux City, Iowa, and also for the new Valmont steam station of the Public Service Company of Colorado, as well as for the complete electrification program of the Long Island Railroad.

Wetmore-Savage Becomes Westinghouse Lamp Distributor

The Wetmore-Savage Company, electrical supply jobber, Boston, has entered into an agreement with the Westinghouse Lamp Company under the terms of which this house will distribute the products of the latter in New England.

Worcester Jobber's Business Gains

"November sales of the E. M. Fay Electric Company, Worcester, Mass., ran 25 per cent ahead of last year, and the prospect is that our 1924 business will exceed that of 1923, notwithstanding the summer depression," declared President E. M. Fay recently.

This house has just added 2,500 sq.ft. of stockroom space to its quarters at 181 Commercial Street on account of the increasing demand for the Horton line of electric washers and ironers. C. Robert Stanton has joined the staff and will cover the Boston

north and south shore districts for the company, with headquarters at Wollaston. Russell Poirson of the Horton factory sales staff is making headquarters at the Fay company's offices. The Fay company has lately become a distributor for the Simplex Electric Heating Company, Cambridge, Mass.

Westinghouse Receives Order from Commonwealth Edison

The Westinghouse Electric & Manufacturing Company has just received an order for substation equipment amounting to $123,000 from the Commonwealth Edison Company of Chicago. The contract calls for three 3,000-kw., shunt-wound, semi-inclosed synchronous converters, three 3,000-kva., 12,000-volt high-tension transformers, one 500-kw. motor-generator set and switching equipment. Provision has been made for the total inclosure of the converters, but at present only the rocker ring will be inclosed.

The General Electric Company has just closed a contract for the lighting of Alhambra, Cal., totaling approximately $100,000. The order calls for 300 ornamental "Novalux" units. The cable and other materials necessary for the installation will also be supplied by the company.

The Tubular Woven Fabric Company, Pawtucket, R. I., announces the appointment of R. F. Whitmore, 9 West Thirteenth Avenue, Denver, as its agent for the Rocky Mountain section, covering Colorado, Wyoming, Montana, Idaho, Utah and New Mexico. A complete stock of "Durabilt" products will be carried in Denver to give service to the jobbers in that section. A warehouse has also been opened up in St. Louis at 1524 Olive Street, where a complete stock will be carried. This office is in charge of E. C. Johnston, who has been salesman in that territory with the company for a little more than a year.

The Crescent Truck Company, Lebanon, Pa., announces that A. H. Krigger, 404 House Building, Pittsburgh, has taken over the sales of the Crescent electrical industrial truck and tractor for the Pittsburgh territory.

The Sangamo Electric Company, Springfield, Ill., announces that its types HP-2 and HP-3 portable test meters, used for testing watt-hour meters, are now being regularly supplied with a fuse in the 1 amp. coil circuit. The type HP-6 meter will continue to be made with fuses for both the 1-amp and 10-amp. coils.

The Monitor Controller Company, Baltimore, announces that its "Monitor Thermaload" starters are now being built with standard monitor side-arm contactors instead of the special contactor previously employed. Hairpin-shaped thermal elements are also being supplied instead of the coiled elements previously used. These new thermal elements are interchangeable with the coiled elements previously used and are all of the same size, permitting the horsepower rating of a thermal starter to be quickly changed, as in the past, by inserting thermal elements of the proper rating.

The Link-Belt Company, Chicago, announces the removal of its St. Louis office from 705 Olive Street to larger and more conveniently located offices at 3638 Olive Street.

The F. W. Wakefield Brass Company, Vermilion, Ohio, has recently appointed Francis I. Wilson as sales manager. Previous to that time Mr. Wilson was a saleman for several years in the employ of the Erner Electric Company, jobber of Cleveland.

The Triangle Conduit Company, Inc., Brooklyn, N. Y., has appointed the Wesco Company, Inc., Denver, as representative for its line of armored cable, flexible metallic conduit and non-metallic conduit in Colorado, Wyoming, New Mexico and Utah.

The Louis Allis Company, Milwaukee, manufacturer of Louis Allis and Watson direct-current and alternating-current motors, announces that its New York office has been removed from 345 Madison Avenue, to room 801, 8 East Forty-first Street.

The Atwater - Kent Manufacturing Company, Philadelphia, manufacturer of electric specialties, wireless equipment, etc., has awarded a contract for the erection of a new plant addition at Wissahickon and Abbottsford Avenues, to cost about $300,000, with equipment.

The G. & W. Electric Specialty Company, 7440 South Chicago Avenue, Chicago, manufacturer of distribution specialties, will soon break ground for a new factory at Anthony and Kimbark Streets, reported to cost about $50,000. A general building contract has been awarded to the Austin Company, 160 North La Salle Street, Chicago.

James A. Vaughn, manufacturers' representative, announces the removal of his office to 1104 Packard Building, at Fifteenth and Chestnut Streets, Philadelphia.

The Dudlo Manufacturing Corporation, Fort Wayne, Ind., manufacturer of wire, coils, etc., will proceed with the construction of a one-story addition to its plant, 100 ft. x 300 ft., for a considerable increase in production. It will cost approximately $100,000, including machinery.

The Linzer Electric Motor Company, Mansfield, Ohio, recently incorporated with a capital of $75,000 by Albert G. Linzer, Harry S. Black and associates, has plans under way for the establishment of a local factory for the manufacture of fractional-horsepower motors and equipment.

The Westinghouse Electric & Manufacturing Company has received an order amounting to approximately $1,250,000 for railway equipment for the Brooklyn City Railroad Company.

New Equipment Available

Circuit Breakers

Double-pole "interlocked-trip" and "shock-proof" circuit breakers are new types being placed on the market by the Roller-Smith Company, 233 Broadway, New York. The interlocked-trip breaker is so arranged that the two poles are closed independently and successively. Should an overload exist the pole first closed will open as soon as the second pole is closed, and after both poles are closed if an overload should occur both poles will open simultaneously. This type of breaker is intended for use largely on motor and feeder circuits in place of switches and fuses.

"Shock-proof" circuit breakers are intended for operation under conditions of excessive vibration or subjection to mechanical shocks as to cause undesired opening. Any listed standard-type circuit breaker can be supplied with shock-proof attachments to meet any requirements. It is said that the addition of this attachment does not alter materially the appearance, size or method of operation.

Reversible Socket Wrench.—A reversible socket wrench has just been placed on the market by the Black & Decker Manufacturing Company, Towson, Md. The machine is similar to other Black & Decker portable electric drills except that the spindle is provided with a clutch which automatically releases when the forward pressure on the tool is relieved. A nut, bolt or stud can be driven to any desired tightness, and the machine is said to have ample power to kick loose nuts or bolts regardless of how tight they are drawn up. A quick-change chuck is provided for holding the different-size socket wrenches.

Electric Slate and Marble Drill.—An electric slate and marble drill that is also adapted for some glass-drilling operations, has been placed on the market by the Hisey-Wolf Machine Company, Cincinnati. The machine is equipped with ball bearings, is provided with a "Universal" motor and weighs only 10 lb. The speed of the drill is only 110 r.p.m., and it has a capacity up to a ½-in. drill.

Single-Drum Hoist.—A single-drum electric hoist, available in three sizes, 500 lb., 1,000 lb. and 2,000 lb. respectively, and known as the "Everedy," has been placed on the market by the Reading Chain & Block Corporation, Reading, Pa. The smallest of the three sizes weighs 215 lb. and is rated to lift its load at 41 ft. per minute on alternating current and 33 ft. per minute on direct current. The standard length of lift is 15 ft. The crane is worm-and-gear-operated and the gearing is self-braking. The motor is ceiling-mounted upon an extended support at one end of the hoist and may be removed conveniently. An automatic adjustable-limit stop is provided and works in conjunction with the hoist controller.

New Trade Literature

INSULATION.—"A Romance in Industry" is the title of a small bulletin issued by the Bakelite Corporation, 247 Park Avenue, New York City, in which it calls attention to the many uses for "Bakelite, the Material of a Thousand Uses." The company has also issued a small booklet in which it discusses the use of "Bakelite" for radio insulation.

TESTING MACHINE FOR PORCELAIN INSULATORS.—Alfred J. Amsler & Company, Schaffhouse, Switzerland, have issued a leaflet describing and illustrating their 20-ton testing machine for porcelain insulators.

BLOWERS.—The L. J. Wing Manufacturing Company, 352 West Thirteenth Street, New York City, has issued bulletin No. 26 A, covering the Wing type "EM" blower for burning small anthracite screenings and slack.

ARMATURE CONSTRUCTION FOR MOTORS.—The Century Electric Company, 1,827 Pine Street, St. Louis, has issued a folder entitled "The Armature Construction of Century Polyphase Motors," in which it gives details of the armature assembly of the Century type "S-C" polyphase motor.

CEMENT.—The Atlas Lumnite Cement Company, 25 Broadway, New York City, is distributing a booklet entitled "Twenty-four-Hour Concrete with Atlas Lumnite Cement," in which it describes the manufacture of "Lumnite" cement, the chemical composition of the product and its various uses.

ELECTRIC RANGES, HEATERS, ETC.—Catalog No. 14 issued by the Standard Electric Stove Company, 1714 North Twelfth Street, Toledo, Ohio, contains a list of its products, including electric ranges, fireless cookers, water heaters, serving tables, etc.

CONDENSERS.—The eighth edition of a handbook of steam tables entitled "Steam Tables for Condenser Work" has just been issued by the Wheeler Condenser & Engineering Company, 149 Broadway, New York. In the steam tables the pressures below atmosphere are expressed in inches of mercury referred to a 30-in. barometer. The book also includes a discussion of the use of the mercury column, the errors in such measurements and constants for their correction.

RUST PREVENTION.—"Rust and Rust Prevention" is the title of a folder issued by the American Rust Proof Company, 8 West Fortieth Street, New York. The folder discusses the corrosion losses of iron and describes the company's rust-preventive product, "Vatu," and its use on metal. This product, the folder says, will prevent rust or tarnishing for at least two years on articles kept in storage.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Constantza, Rumania (No. 12,644), for machinery for mining graphite, drilling, crushing, screening and pulverizing and a portable soldering and welding machine (generator and engine-acetylene).

Purchase is desired in Warsaw, Poland (No. 12,699), for electrolytic and commercial copper.

An agency is desired in Vienna, Austria (No. 12,713), for labor-saving devices.

Purchase and agency is desired in Bahia, Brazil (No. 12,629), for wire.

An agency is desired in Melbourne, Australia (No. 12,637), for heat and humidity control apparatus.

Purchase and agency is desired in Budapest, Hungary (No. 12,679), for vacuum cleaners.

NEW ELECTRIC STATION PROPOSED FOR TOKYO, JAPAN.—To provide for additional power to replace that formerly generated at the two municipal stations at Shibaura and Shinagawa, both of which were destroyed by the earthquake in 1923, the city of Tokyo, according to *Commerce Reports*, has decided to build one large steam-driven electric generating station as soon as a suitable location can be procured. This station will be located along Tokyo Bay, and the equipment will consist of two 5,000-kw. turbo-generators, together with necessary boilers, condensers and auxiliary equipment. The cost is estimated at 1,500,000 yen (1 yen = $0.38 at present rate of exchange). Most of the power generated will be utilized by the Tokyo street car system, but part of it will be used for street-lighting service within the city limits. Mr. Tojo, who at the present time is connected with the Kinugawa Hydro-Electric Company, will be in charge.

New Incorporations

THE LOUISIANA POWER COMPANY, 825 Equitable Building, Baltimore, Md., has been incorporated by Richard F. Cleveland, Gaylord Lee Clark and others.

THE SANDY RIDGE ELECTRIC COMPANY, Hickory, N. C., has been incorporated by Carl E. Probst, B. T. Barney and others.

THE MORRISON LIGHT & POWER COMPANY, Statesville, N. C., has been incorporated by W. D. Morrison, John R. Morrison and others.

THE MATADOR (TEX.) ELECTRIC & ICE COMPANY has been incorporated by Glen Sample, H. G. Crowley and others. The company is capitalized at $20,000.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

RUMFORD, ME.—Sketches are being made by Rogers & Dion, 142 Berkeley Street, Boston, for hospital, nurses' home and power house, to cost about $150,000, for the Community Hospital Association.

LYNN, MASS.—The Lynn Gas & Electric Company contemplates enlarging its office building. The cost is estimated at about $100,000.

RICHMOND, MASS.—The Pittsfield Lime & Stone Company, 152 West Forty-second Street, New York, plans to install electric power equipment in connection with proposed extensions in its local plant, to cost about $200,000. Richard T. Meade & Company, 13 East Fayette Street, Baltimore, are engineers.

WHITINSVILLE, MASS.—Arrangements are being made by the Whitin Machine Works to utilize the water power at the Whitinsville Cotton Mills to generate electricity for its works.

Middle Atlantic States

ASHFORD, N. Y.—Application has been made to the Public Service Commission by the Olean (N. Y.) Electric Light & Power Company for permission to extend its transmission lines in the town of Ashford to furnish electricity here.

BINGHAMTON, N. Y.—The plant and holdings of the Afton-Windsor Light, Heat & Power Company, Center Village, have been acquired by the Binghamton Light, Heat & Power Company. Contract, it is understood, has been awarded by the Binghamton company for the erection of a transmission line from Willow Point to Susquehanna, to cost about $169,000. After the completion of this line the same contractors will extend the new power line 10 miles further eastward to connect with the system of the Windsor-Afton company. This extension will cost about $50,000.

BROOKLYN, N. Y.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for electric lighting systems in the combined boiler and incinerator plants at the local naval hospital and for a radial brick stack (Specification 5032).

BROOKLYN, N. Y.—Bids will be received by the superintendent of school buildings, Board of Education, Flatbush Avenue Extension and Concord Street, Brooklyn, until Jan. 6, 1925, for electric wiring and fittings and gas and electric fixtures for new Public School 105, Fort Hamilton Avenue.

GENOA, N. Y.—The Ledyard Electric Company, Aurora, has applied to the Public Service Commission for permission to erect a distribution and transmission system in Genoa and also for approval of a franchise granted by the Town Board.

IRONDEQUOIT N. Y.—Local residents are agitating the question of lighting the highway north of Seneca Road and east of Durand-Eastman Park. Edwin H. Schlueter is interested in the project.

KINGSTON, N. Y.—The Certified Ice & Refrigeration Company, 11 Moore Street, New York, plans to install electric power equipment at its proposed local ice-manufacturing and refrigerating plant, to cost about $250,000. William Hexamer, 932 Chestnut Street, Philadelphia, is engineer.

NEW YORK, N. Y.—Bids will be received by the superintendent of school buildings, Board of Education, Flatbush Avenue Extension and Concord Street, Brooklyn, until Dec. 24 for electric wiring and lighting fixtures for new Public School 81, Riverdale Avenue, Borough of the Bronx.

SPENCER, N. Y.—Permission has been granted the New York State Gas & Electric Corporation, Ithaca, to acquire the electric generating plant and distributing system in Spencer, Van Etten and Candor owned by the Seely Electric Company, Spencer. The New York State Corporation plans to erect a transmission line to connect the Seely system with its own. Franchises granted the New York State Corporation in the above towns and by the town of Carolina have been approved by the Public Service Commission.

BUTLER, N. J.—The Borough Council has granted the Central Jersey Light & Power Company permission to erect a line to furnish electricity to the plant of the American Hard Rubber Company and for other commercial service.

CAMDEN, N. J.—Bids will be received by Elmer E. Stafford, chairman of committee on central plant, Board of Chosen Freeholders, Court House, Camden, N. J., until Dec. 29 for furnishing and installing boiler-feed and condensate pumps, general power plant piping, valves, fittings, etc., in the central power plant on the grounds known as the County Farm, near Asyla. Frank H. Schaefer, Temple Building, Camden, is engineer.

ELIZABETH, N. J.—Application has been filed by the Singer Manufacturing Company for a permit to erect an addition to its rolling mill, to cost about $50,000. The new building will be used for an electrical annealing plant.

NETCONG, N. J.—The New Jersey Power & Light Company, Dover, has received permission to purchase the system of the Vulcan Power Company. Extensions in the transmission system are contemplated.

PERTH AMBOY, N. J.—The Public Service Electric & Gas Company, Newark, has applied for permission to install two submarine cables in the Raritan River, from Perth Amboy to South Amboy, consisting of two 350,000-circ.mil cables, to carry 26,400 volts.

ELKINS PARK, PA.—Bids will be received by the School District, Cheltenham Township, until Dec. 30, for electrical work, etc., in the proposed local high school. The cost of the building is estimated at $600,000. Davis, Dunlap & Barney, 1805 Walnut Street, Philadelphia, Pa., are architects.

JEDDO, PA.—The Jeddo-Luzerne Power & Light Company is being organized as a subsidiary of the Pennsylvania Power & Light Company to construct a transmission system in this section.

NEW BRIGHTON, PA.—Plans are being considered by the light committee of the City Council for the installation of an ornamental lighting system on Third Avenue.

PHILADELPHIA, PA.—The Board of Public Works has filed plans for the construction of a transformer station on Weatsheaf Lane, near Richmond Street, to cost about $25,000.

PHILADELPHIA, PA.—The Philadelphia Electric Company has taken out a permit to erect a power plant on Delaware Avenue, near the Pennsylvania Railroad, to cost about $35,000.

PITTSTON, PA.—Plans are being considered by the City Council for the installation of an ornamental lighting system on Main Street, using iron standards.

NEW CASTLE, DEL.—The Penn Seaboard Steel Corporation, Franklin Bank Building, Philadelphia, plans to install electric power equipment at its local mills in

connection with extensions to cost about $850,000.

WILMINGTON, DEL.—The contract for installing an ornamental lighting system, consisting of eighty-three arc lamps, on Fourth Street has been awarded to the Wilmington-Philadelphia Traction Company. The cost is estimated at about $56,000. The new lamps will be installed at once, but will not be put in service until May 1, 1925.

BALTIMORE, MD. — Plans are under way by the Consolidated Gas, Electric Light & Power Company for the erection of a 60,000-volt transmission line from the Highlandtown power station of the McCall's plant to the Summerfield station. Substations will be erected at Delight, Texas and other points. The company also proposes to erect a transmission line to furnish service in about 20 miles of territory in outlying sections of the city and in Baltimore County.

BROWNSVILLE, MD.—Permission has been granted to the Harpers Ferry (W. Va.) Electric Light & Power Company by the County Commissioners to extend its transmission from Weverton to Brownsville.

RICHWOOD, W. VA.—The Cherry River Boom & Lumber Company plans to install electric power equipment in connection with the proposed rebuilding of its local mills, recently destroyed by fire with a loss of about $300,000.

RICHMOND, VA.—Plans are under consideration by the Virginia Railway & Power Company for extending its transmission lines to Elkhardt, a distance of about 4½ miles.

WOODSTOCK, VA.—The Valley Light & Power Company is planning to extend its transmission line to Mount Jackson.

WASHINGTON, D. C.—Bids will be received at the office of the General Purchasing Officer, the Panama Canal, Washington, D. C., until Jan. 8, 1925, for Diesel engine generator equipment for standby generator stations. For details see Searchlight Section.

North Central States

ALLEGAN, MICH. — Extension of the ornamental lighting system throughout the business section, to cost about $15,000, is under consideration by the City Council.

CALUMET, MICH. — The Calumet & Hecla Company plans to install electric power equipment in connection with enlargements in its copper smelting plant.

ESCANABA, MICH.—Bids will soon be asked by Fred R. Harris, City Manager, for the installation of an ornamental lighting system on portions of North and South Third Street, South Seventh Street, North Fourteenth Street, South First Avenue and Lake Shore Drive.

FLINT, MICH.—The Consumers Power Company is considering the construction of two local substations, to cost about $65,000.

KALAMAZOO, MICH.—The City Council plans to install additional equipment at the municipal electric light and power plant, to cost about $36,000.

ST. IGNACE, MICH.—The installation of a new street-lighting system in State Street is under consideration by the Board of Public Works.

CLEVELAND, OHIO.—The City Council has approved an ordinance providing for an expenditure of not more than $250,000 for the installation of a steam boiler, its settings, forced and induced fans, economizers, pipings and auxiliaries, etc., for the Division of Light and Power.

CLEVELAND, OHIO.—Plans have been approved by the City Council for improvements and extensions to the municipal electric plant, involving an expenditure of about $1,500,000. It is proposed to increase the generating capacity from 35,000 kw. to 50,000 kw., with proper transmission and distribution facilities. The original plans called for an expenditure of $2,961,000. Harold Wright is Director of Public Utilities.

YOUNGSTOWN, OHIO.—The Erie Railroad Company, 50 Church Street, New York, plans to install electric power equipment in the proposed addition to its repair shops in the Brier Hill district, in connection with an expansion program in this section to cost about $2,500,000.

AMO, IND. — The Merchants' Heat & Light Company, Indianapolis, has applied for permission to purchase the system of the Amo Light, Heat & Power Company. Extensions and improvements are contemplated.

ANDERSON, IND.—The installation of an 6,000-kw. generating unit and underfeed stokers for boilers in the municipal electric light plant during 1925 is under consideration.

GARY, IND.—The Calumet Gas & Electric Company has secured a contract from the Gary Tube Company for furnishing electricity for the new tube works at Gary. Energy will be supplied from the substation at Aetna.

INDIANAPOLIS, IND.—Application has been filed with the Federal Power Commission by John A. Schafer, Indianapolis, for a preliminary permit covering a power development on the Wabash River. The project includes the construction of a dam on the Wabash River at Great Rapids and two dams in the East Fork of White River. It is estimated that 170,000 hp. can be developed.

INDIANAPOLIS, IND. — The Indiana Electric Corporation has applied for permission to purchase the plant and system of the Charlottesville (Ind.) Light, Heat & Power Company. The company is also arranging to take over the power plant of the Carthage (Ind.) Electric Light Plant. Extensions will be made in transmission lines.

KOKOMO, IND.—The Northern Indiana Power Company is negotiating for the purchase of the plant of the Akron Light, Heat & Power Company. Other properties to be taken over and consolidated are the Farmers' Mutual Light & Power Association, Sidney, and the Denver (Ind.) Electric Light & Power Company, a lighting plant at Chili, Larville (Ind.) Light & Power Company and lighting systems at Mexico and Whitestown. The purchasing company plans extensions to its transmission system.

MARION, IND.—The City Council has engaged Harry Gorman, Indianapolis, consulting engineer, to prepare plans and specifications for a municipal light and power plant.

PEORIA, ILL.—The Commercial Solvents Corporation, 17 East Forty-second Street, New York, contemplates the installation of electric power equipment in connection with the proposed addition to its local plant, to cost about $500,000.

HORICON, WIS. — Arrangements have been made by City Council with the Wisconsin Power, Light & Heat Company for the installation of an ornamental lighting system covering the entire business district. The plans call for fifty standards equipped with lamps of 250 cp.

MILWAUKEE, WIS.—The board of directors of the Milwaukee Auditorium is considering the installation of a steam-driven electric generating plant to supply electricity for the building. J. C. Grieb is manager.

BIWABIK, MINN.—The Borough Council is considering the erection of a transmission line to South Biwabik, a distance of about 10 miles, to supply commercial service in that district.

MINNEAPOLIS, MINN.—The installation of an ornamental lighting system on Franklin Avenue from Cedar Avenue to the Cappelen Memorial Bridge is under consideration.

OWATONNA, MINN.—New distributing lines are being erected by the Interstate Power Company, Chicago, to serve a number of farms in Martin County. The company, it is stated, plans to build a network of such lines in the near future in this section of the state and will eventually extend the rural service over all the territory served by the company in southern Minnesota and northwestern Iowa.

RED WING, MINN. — The Northern States Power Company, Chicago, has been granted permission by the City Council to extend its transmission line across the Mississippi River to supply electricity for lamps and motors in Hager City, Bay City and other points in the southern part of Pierce County, Wisconsin, which are now without electrical service.

CEDAR RAPIDS, IOWA. — The Iowa Electric & Power Company has been granted permission to build a dam on the Skunk River in connection with the rebuilding of its plant at Oakland Mills, which furnishes electricity to Fairfield, Stockport and other places. The new dam will be located a short distance below the old one. The proposed plant will develop about three times the capacity of the present station.

FENTON, IOWA.—Negotiations are reported to be under way by the Iowa Falls Electric Company, Cedar Rapids, for the purchase of the municipal electric plant.

AURORA, MO. — Permission has been granted to the Lawrence County Water, Light & Cold Storage Company to erect a transmission line to supply electricity in outlying sections.

MOUNTAIN GROVE, MO.—A project is reported to be under way by H. A. Spaulding and C. K. Rowland, Boatmen's Bank Building, St. Louis, for the consolidation of the electric plants in Ava, Mountain Grove, Mansfield, Seymour, Hartville, Cabool and Willow Springs, with a view of supplying electricity to all these towns from a large central power plant.

ST. LOUIS, MO. — The Central Power Company, Chemical Building, contemplates improvements to hydro-electric plants on the Spring River in Arkansas. As yet nothing definite has been decided upon.

CENTERVILLE, S. D.—Bonds for $9,000 have been voted for the installation of an ornamental lighting system on Main Street, for which bids will soon be asked.

BROADWATER, NEB. — The citizens have voted to sell the municipal electric light plant to the Western Public Service Company, Colorado Springs. Electricity to operate the local system will be furnished from the Bridgeport plant of the company.

FORT SCOTT, KAN. — Application has been made by the Kansas Utilities Company to the Public Utilities Commission to do business in Paola and all other towns in Miami, Anderson and Allen Counties not now served by an electric company.

WICHITA, KAN.—Application has been made to the Public Utilities Commission by the Kansas Gas & Electric Company to erect 3 miles of heavy transmission lines in Crawford County to serve the mines of the Sheridan Coal Company.

Southern States

CLINTON, S. C.—A petition has been presented to the City Council requesting that an election be held to vote on the proposal to issue $235,000 in bonds for street, paving, ornamental lighting system, sewer and water main extension.

LAURENS, S. C.—The installation of an ornamental lighting system, maintained by underground wires, is under consideration by the Commissioner of Public Works. The cost is estimated at about $8,000.

AUGUSTA, GA.—Bids will be received by the Construction Division, United States Veterans' Bureau, Arlington Building, Washington, D. C., until Jan. 6, for the installation of a fire-alarm system at the local station.

POLK CITY, FLA.—The Polk City Utilities Company, recently organized with a capital of $100,000, has tentative plans for the construction of an electric light and power plant for local commercial service. Isaac Van Horn is president.

ST. PETERSBURG, FLA. — Petitions have been presented to the City Commission by property owners on First Avenue, Euclid Boulevard, Ninth Street and Fourth Street for the installation of ornamental lamps on portions of those thoroughfares.

SEBRING, FLA.—Bids are being asked by the City Council for a 300-hp. oil engine for the municipal electric light plant, to be installed by Feb. 1, 1925.

CHATTANOOGA, TENN.—The Tennessee Electric Power Company is considering erecting a 44,000-volt transmission line to Daisy and Soddy, a distance of about 14 miles, during 1925. The cost of the proposed line is estimated at about $165,000.

MEMPHIS, TENN. — Plans are under consideration by the Commissioner of Public Utilities to install an ornamental lighting system on Second Street from Popular Boulevard to Calhoun Avenue, to cost about $20,000.

SHEFFIELD, ALA.—The plant and holdings of the Sheffield Company, which owns and operates an electric power plant, interurban car line and water system in Sheffield, have been acquired by the Alabama Power Company, Birmingham.

WAYNESBORO, MISS.—The installation of an additional generating unit is under consideration by the Waynesboro Light & Ice Company.

DE QUINCY, LA.—The Gulf Coast Railroad, Houston, Tex., plans to build a power plant, in connection with new local shops.

BRYAN, TEX. — The Houston (Tex.) Lighting & Power Company is negotiating for the purchase of the municipal electric light and power plant. Extensions in its transmission system are planned in this district.

DALLAS, TEX.—The City Commission has granted the petition of the Dallas Power & Light Company to construct an additional unit to its local electric power plant, to cost about $2,582,700.

DALLAS, TEX.—Work will soon begin by the Texas Public Utilities Company, a subsidiary of the Southwestern Power & Light Company, New York, on the construction of an electric generating station which will have an initial capacity of 40,000 kw. and an ultimate output of 150,000 kw. The new station will be located in the Texas lignite fields on the Trinity River, near Trinidad. The initial installation will consist of two 20,000-kw. units, with four high-pressure high-superheat boilers, which will be equipped to burn lignite. Provision will be made so that gas or oil-burning equipment can be installed if desirable.

NEW BRAUNFELS, TEX.—Preliminary plans have been completed for the construction of an electric power plant on the Guadalupe River, near here, to supply electricity in San Antonio. The proposed plant will be built and operated by the Comal Power Company, a subsidiary of the San Antonio Public Service Company, which has made application to the State Board of Water Engineers for water rights on the Guadalupe River for the project.

SAN ANGELO, TEX.—The West Texas Utilities Company, Abilene, plans to erect transmission lines in connection with the purchase of the properties of the Interstate Electric Corporation at Winters, Miles, Rowena, Ballinger and San Angelo.

Pacific and Mountain States

BELLINGHAM, WASH.—Extensions and improvements contemplated by the Bloedel-Donovan Lumber Company, include enlarging its lumber plant and rebuilding its electrically operated box factory, recently destroyed by fire. The cost is estimated at $500,000.

SEATTLE, WASH.—The City Council is planning to install an improved lighting system on Rainier Avenue from Lucile to Mead Street.

BAKERSFIELD, CAL.—The Kern River Storage District has applied to the Federal Power Commission for a preliminary permit for a power project on Kern River in Kern County.

BAKERSFIELD, CAL.—Application has been made to the Federal Power Commission by the Kern River Storage District for a preliminary permit for a hydro-electric development on the Kern River in Kern County. The project includes a dam about 140 ft. high and 1,000 ft. long, near Isabelle, creating a reservoir of about 390,000 acre-feet, and a power house below the dam; also a diversion dam about 1½ miles farther down the stream and a pressure tunnel 1 mile long leading to another power house near the river. The power will be used to operate pumps for irrigation purposes, etc.

LOS ANGELES, CAL.—The Department of Public Service plans to build an electric station on Vose Street, near Radford Street, to cost about $25,000.

LOS ANGELES, CAL.—Bids are being asked by the Board of Public Works for street lamps as follows: On Eighth Street, 197 pressed-steel standards; Western Avenue, 137 and on Moneta Avenue, 380, to cost about $100,000.

LOS ANGELES, CAL.—The City Council has approved an ordinance for the installation of ornamental lamps on Tamarind Avenue, consisting of twenty-four concrete standards; also on Santa Monica Boulevard, using 102 pressed-steel standards.

PASADENA, CAL.—The Board of City Trustees is considering the installation of an ornamental lighting system on East California Street from South Fair Oaks to South Lake Avenue, using concrete standards. Plans are also under way for the installation of an underground conduit system in the San Rafael district.

RIVERSIDE, CAL.—Steps are being taken for the extension of the ornamental lighting systems on Market Street and Magnolia Avenue to Madison Street.

RICHMOND, CAL.—The installation of an electrolier lighting system on Tenth Avenue from Macdonald to Novin Avenue is under consideration.

SALT LAKE CITY, UTAH.—Permission has been granted to the Utah Power & Light Company by the State Engineer for the diversion of 2,500 second-feet of water of Bear River, with storage for 75,000 acre-feet. Work, it is understood, will soon being on the construction of a 35,000-kw. hydro-electric plant (two units of 15,000 kw. each) on what is known as the Cutler site on Bear River. The cost is estimated at about $5,500,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued November 18, 1924)

1,516,415. ATTACHMENT PLUG; George B. Thomas, Bridgeport, Conn. App. filed Nov. 20, 1919.

1,516,422. ELECTRICALLY INSULATING PIPE SECTION FOR HIGH-VACUUM PIPE LINES; Walter Dallenbach, Baden, Switzerland. App. filed July 31, 1922.

1,516,440. ELECTRIC SWITCH; George A. Johnson, Bridgeport, Conn. App. filed Aug. 9, 1922. Toggle-mechanism type.

1,516,471. APPARATUS FOR WELDING METAL; Charles H. Stoody, Winston F. Stoody and Shelley M. Stoody, Whittier, Cal. App. filed Dec. 22, 1922.

1,516,476. AUTOMATIC INCUBATOR; Jacques Perrot, Liguge, France. App. filed June 26, 1924.

(Issued November 25, 1924)

1,516,493. CONTROLLING DEVICE; Warren F. Clark, Cleveland, Ohio. App. filed June 7, 1919. For controlling an electric heating coil in accordance with temperature conditions existing in the device being heated by the coil.

1,516,501. LIGHTING FIXTURE; John K. Riddle, Toledo, Ohio. App. filed Dec. 17, 1923. Provided with an arm which carries an electric light at its extremity.

1,516,518. SIGNALING SYSTEM; John R. Carson, Montclair, N. J. App. filed July 7, 1920. For long signaling circuits, as submarine cable circuits.

1,516,519. ELECTRICAL TRANSFORMER; George Crisson, Hackensack, N. J. App. filed Dec. 14, 1923. For use with telephone circuits having repeaters connected therewith.

1,516,520. PLURALLY FUSED SOCKET HEAD; Louis Cross, Brooklyn, N. Y. App. filed Oct. 6, 1922.

1,516,526. HYDRAULIC STARTER FOR ELECTROMOTORS AND THE LIKE; Georg L. Ganss, Gross-Umstadt, Germany. App. filed May 28, 1923. As used with slip-ring motors.

1,516,539. SELECTOR AND CONNECTION; Frank A. Lundquist, Chicago, Ill. App. filed Sept. 27, 1920. For use in automatic telephone exchanges.

1,516,560. INSULATOR TIE; Charles Zimmer, Edinboro, Pa. App. filed Oct. 21, 1920. Such that the conductor can be released by a pole to facilitate changing the insulator on a high-tension line.

1,516,570. TRAFFIC SIGNAL; Victor R. Mellenbruch, Burdick, Kan. App. filed April 15, 1922.

1,516,581. ELECTRIC CONTACT PLUG; Hermann Seufert, Brooklyn, N. Y. App. filed Nov. 2, 1922. Combination male or female plug.

1,516,585. INSULATOR; Arthur O. Austin, Barberton, Ohio. App. filed Dec. 6, 1920. For high potentials.

1,516,595. ELECTRICAL REPRODUCER FOR PHONOGRAPHS; Pierre V. Frely, Paris, France. App. filed March 30, 1921.

1,516,615. AUTOMATIC CIRCUIT-CONTROLLING DEVICE FOR POWER-OPERATED VEHICLES; John M. Meile, East St. Louis, Ill. App. filed Feb. 28, 1921. That will automatically open, close or shunt an electric circuit according to variations in the speed of the vehicle.

1,516,636. TIME SYSTEM; George A. Goodson, New York, N. Y. App. filed Oct. 30, 1914. For time clocks; with a central control.

1,516,646. ELECTRIC RESISTANCE MATERIAL AND PROCESS FOR MANUFACTURING THE SAME; Philip N. Roseby, Liverpool, England. App. filed July 25, 1921.

1,516,650. VIBRATORY RELAY; Sidney R. Smith, London, England. App. filed Oct. 18, 1920. For indicating or utilizing minute vibratory movements of a size incapable of giving a visual indication or of operating an electrical contact.

1,516,651. PROCESS FOR THE PRODUCTION OF ZINC IN ELECTRIC FURNACES; Filip Tharaldsen, Christiania, Norway. App. filed Aug. 15, 1922.

1,516,653. THERMOSTATIC CIRCUIT-CONTROLLING DEVICE; Edgar Tregoning, Attleboro, Mass. App. filed Nov. 1, 1920. For shutter-and-damper-control systems.

1,516,657. ELECTRIC HEATER; Henry A. Ziola, Cleveland, Ohio. App. filed Feb. 27, 1922. Hot-plate type.

1,516,680. TELEPHONE RECEIVER; Earl P. Oswald, Detroit, Mich. App. filed July 7, 1922.

1,516,736. ELECTRICAL SWITCH BOX; Herbert E. Kammerer, Los Angeles, Cal. App. filed Dec. 18, 1920. Safety type.

1,516,753. TIME SWITCH; Fred T. Richards, Los Angeles, Cal. App. filed Dec. 4, 1922. To illuminate certain signs for a limited period during the night.

1,516,768. FLASHLIGHT; Edward H. Findlay, Fairfield, Iowa. App. filed April 17, 1923. With self-contained generator.

1,516,781. CONDUIT SUPPORT FOR ELECTRICAL APPARATUS; Oscar F. Nylen, Chicago, Ill. App. filed May 21, 1923. As the lead to an electric iron.

1,516,836. ELECTRIC WELL HEATER; James E. Williamson, Pittsburgh, Pa. App. filed Feb. 23, 1923. For oil wells.

1,516,863. SWITCH-POINT LEAD; Thomas Lundberg, Everett, Mass. App. filed Nov. 22, 1922. As used in radio apparatus to avoid soldering.

1,516,864. METHOD OF MANUFACTURING TROLLEY-WIRE SUPPORTS; Samuel S. Matthes, Mansfield, Ohio. App. filed Aug. 30, 1923.

1,516,884. WIRELESS TIE INSULATOR; Harry A. Frederick, Chicora, Pa. App. filed March 31, 1921. For supporting a cable without the use of a tie wire.

1,516,908. CIRCUIT MAKER AND BREAKER; Leonard S. Baluta and Oscar W. Althoff, Berwick, Pa. App. filed Dec. 1, 1921. For use in connection with auxiliary lighting systems.

1,516,970. ELECTRIC FURNACE FOR HEATING SOLDERING COPPERS; Walter H. Kiger, St. Louis, Mo. App. filed Aug. 17, 1922.

1,516,974. ELECTRIC BATTERY; William R. Loveman, Bridgeport, Conn. App. filed July 31, 1920. Dry-cell type.

1,517,025. MAGNETIC CHUCK; Frank L. Simmons, Woonsocket, R. I. App. filed June 7, 1919.

1,517,033. IGNITION GENERATOR; Richard Varley, Englewood, N. J. App. filed July 1, 1920.

1,517,042. ELEVATOR CONTROL; Carl J. Anderson, Chicago, Ill. App. filed Aug. 9, 1922.

1,517,057. VACUUM-TUBE AMPLIFIER; David Grimes, Grasmere, N. Y. App. filed Sept. 19, 1922.

1,517,058. INVERSE-DUPLEX VACUUM-TUBE CIRCUIT; David Grimes, Grasmere, N. Y. App. filed Dec. 1, 1923.

1,517,061. DISCONNECTING SWITCH; Lester C. Hart, Cleveland, Ohio. App. filed April 11, 1924. High-voltage switch of the inclined-insulator-column type.

1,517,063. MEANS FOR DAMPING VIBRATORY STRUCTURES OF VIBRATION APPARATUS; Heinrich Hecht, Hugo Lichte and Bernhard Nielsen, Kiel, Germany. App. filed Oct. 22, 1923. As microphones.

1,517,093. MAGNETO-ELECTRIC GENERATOR; Edward B. Nowosielski, Bloomfield, N. J. App. filed March 12, 1920. Ignition type.

1,517,098. ELECTRIC CIGAR LIGHTER; Edward S. Preston, Chicago, Ill. App. filed May 26, 1924.

1,517,103. PHOTO-ELECTRIC CELL; Theodore W. Case, Scipio, N. Y. App. filed April 26, 1921.

1,517,110. TELEGRAPH-TRANSMITTING APPARATUS; Thomas F. Foley, Brooklyn, N. Y. App. filed May 13, 1922. Automatic.

1,517,117. PHASE CONVERTER; Kalman V. Kando, Budapest, Hungary. App. filed Sept. 17, 1920. Synchronous type.

1,517,122. ELECTRIC FURNACE; Arturo Paoloni, Baden, Switzerland. App. filed Feb. 8, 1921. For baking refractory materials on a large scale.

1,517,127. PUSH-TYPE FLUSH RECEPTACLE FOR ELECTRIC INSTALLATION; Adolph C. Recker, Oakville, Conn., and Herbert C. C. Cady, Waterbury, Conn. App. filed Nov. 5, 1920.

1,517,149. ELECTRIC TOASTER; Anthony F. Cibs and Robert P. Simmons, Cleveland, Ohio. App. filed Dec. 19, 1923.

1,517,157. TROLLEY-WIRE HANGER; Edward Heydon, Indianapolis, Ind. App. filed April 3, 1924. With detachable yoke.

1,517,180. HELMET EMERGENCY LIGHT; George A. Timlin, New York, N. Y. App filed Aug. 13, 1921. For firemen.

1,517,229. FUSE-PLUG; Arthur Brunner, San Francisco, Cal. App. filed July 31, 1922. Renewable multi-unit plug.

1,517,233. ELECTRIC MOTOR CONTROL; Hammond C. Hastings and Charles T. Hanna, Rugby, England. App. filed March 10, 1923. To obtain very low speeds at all loads; particularly applicable for controlling series motors.

1,517,237. ELECTRIC CONDUCTOR OF THE LAMINATED TYPE; Friedrich Kade, Charlottenburg, Germany. App. filed April 18, 1922.

1,517,238. PROCESS OF CONNECTING METAL PARTS BY ELECTRIC WELDING; Richard Stresau, Wauwatosa, Wis. App. filed Dec. 8, 1922. Applicable to the production of vehicle frames.

Financial and Corporate

Utility Market Improves

American Water Works & Electric Company Makes a Spectacular Rise to Fresh "Highs"

ALTHOUGH certain members of the power and light stock group did not do so well as formerly in the week recorded here, most issues either held steady or made a moderate advance. Trading in general has not developed great activity, but business in the unlisted houses has been good of late. Easily the outstanding event of the week was the sensational rise in the price of the American Water Works & Electric Company's stock on the New York Stock Exchange.

Ever since American Water Works & Electric Company's old stock started its upward movement from 40 earlier in the year its advance has been more or less spectacular. At the time the old stock was split on a five-to-one basis —that is, five shares of American Water Works & Electric new were given for one of old—the common stock was selling in the neighborhood of 120. That price was the equivalent of 24 for the new stock, and hundreds of shares were traded in at that level when the new issue was listed. A week ago we recorded a rise to 32¼ in the new shares, which in itself was a sensational rise when it is considered that an advance of one point in the new stock is the equivalent of five points in the old. But this week the new stock under heavy accumulation rose to 39¼, the equivalent of over 196 for the old stock. It means that the old stock this year has risen from 40 to the equivalent of 196.

Carolina Power & Light Company's stock advanced from about 261 to 335, but, of course, the amount of this stock outstanding is relatively small. Moderate gains were achieved by such issues as Southeastern Power & Light, Galveston-Houston Electric, American Gas & Electric, Appalachian and Tennessee Electric Power. Commonwealth Power under heavy buying set a new top at 126

New Capital Issues

During the past week the Western Power Corporation offered the investing public a six-million-dollar issue of thirty-year 6½ per cent sinking-fund secured gold debentures at 98.50 and interest, on a yield basis of 6.60 per cent. The Western Power Corporation, organized in New York, owns all the outstanding common stock of the Great Western Power Company of California and recently acquired control of the San Joaquin Light & Power Corporation and its affiliated companies. These debentures constitute the only funded debt of the corporation and will be secured by the outstanding common stock of the Great Western and by the common stock of the San Joaquin corporation. With the purpose of raising funds for retiring debentures falling due next March and for extensions and improvements to its properties, the Federal Light & Traction Company floated a loan of $2,500,000 in 6 per cent debenture gold bonds, the price being 91 and interest and the yield 6.70 per cent. Two and a half million dollars was contributed to the week's total by the Georgia Light, Power & Railways by an issue of short-term gold notes, the proceeds of which will be partly for refunding purposes and partly for construction. The Central Illinois Light Company offered an additional issue of gold bonds dated April 1, 1913, and due April 1, 1943, amounting to $851,100, at 95½ and interest, to yield over 5⅝ per cent. The Utilities Power & Light Corporation offered 150,000 shares of class A stock for subscription at $25 per share. The stock has priority over class B stock as to both assets and dividends. Because of the splendid earning capacity of the company it is expected that the stock will yield dividends at the rate of $2 per share per annum.

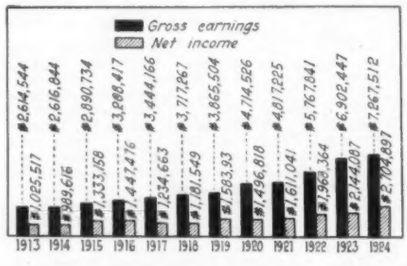
Adirondack Power & Light's Future

Low Water in Fall No Longer Will Handicap This Utility, Which, to Meet the Demand for More Power, Has Doubled Its Capacity Since a Year Ago

BY PAUL WILLARD GARRETT

THE Adirondack Power & Light Corporation came into being four years ago, in 1920, when two large hydro-electric properties in New York State, the Adirondack Electric Power Corporation and the Mohawk Edison Company, Inc., were consolidated. The corporation subsequently acquired other small properties that help to unify the system's operations in a wide territory.

Electric power and light are furnished exclusively to such important places as Schenectady, Amsterdam, Watervliet, Oneida, Saratoga Springs and Glens Falls. The area has developed into an important one from an industrial standpoint, Schenectady being the city, for example, where are the large works of the General Electric Company and the American Locomotive Company. Under long-term contracts Adirondack Power & Light Corporation also furnishes electricity to distributing companies in such places as Troy, Mechanicsville and Canajoharie and to the electric railway systems that serve Albany, Schenectady, Troy, Gloversville, Utica and Rome.



EARNINGS OF THE ADIRONDACK POWER & LIGHT COMPANY HAVE SHOWN CONSISTENT GAINS

Formerly the properties now controlled by the Adirondack Power & Light Corporation suffered from the effects of low water during August, September and October. Adirondack has been almost entirely a hydro-electric enterprise and could not, under old conditions, accept contracts for large deliveries of power throughout the year. To a certain extent demands during off seasons were met through purchases from other companies, but Adirondack, having to pay dearly for such accommodation, was unable to develop its earning power to the maximum.

The management, therefore, with the assistance of the General Electric Company, which owns a substantial block of the Adirondack's stock, set about to rectify the situation. New power plants were arranged for, including a new steam plant at Amsterdam on the Mohonk River. Favorable contracts for power also were made with other companies. Some noteworthy things have been done since a year ago. At the close of last year Adirondack Power & Light's total generating capacity stood at 92,000 kw. During 1924 to date the corporation has increased its capacity by 60,450 kw., not counting 30,000 kw. about to be added from a new steam plant at Amsterdam. Adirondack soon will have a capacity of 182,450 kw., in other words, or nearly twice what it had a year ago.

SHOULD DEVELOP GOOD EARNINGS

These being the facts, Adirondack Power & Light extends promise of greater earnings in the future than are indicated by past figures. However, even under old conditions Adirondack's gross business enjoyed a rather substantial growth. Gross earnings have increased steadily from $2,614,544 in 1913 to $7,267,512 for the twelve months ended October 31, 1924, as will be seen from the accompanying chart; net increased from $1,025,517 to $2,704,897 in the same period. Obviously net earnings have not grown in the past as rapidly as gross, a thing that indicates, with the old problem solved, a relatively smart improvement in net earnings from now on.

Although Adirondack does not pay

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.

Companies	Bid Price Saturday, Dec. 13	Low 1924	High 1924
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	a 98	94	98
Appalachian Power, 7 per cent	a 93	85¼	93
Arkansas Light & Power 7 per cent	a 94	81	96
Asheville Power & Light 7 per cent	a 95	95	99
Central Illinois Public Service 6 per cent	a 85	84	88
Colorado Power 7 per cent	a 92	90	98
Connecticut Light & Power 7 per cent	a105	99	106
Consumers' Power 6 per cent	a 90	85	93
Dayton Power & Light 6 per cent	a101	84	101
Duquesne Light 7 per cent	a105½	102	108½
Eastern Texas Electric 6 per cent	a101	81	105
Empire District Electric 6 per cent	a 77	70	78
Fort Worth Power & Light 7 per cent	a 99	97	103
Great Western Power 7 per cent	a 96	96	99
Illinois Northern Utilities 6 per cent	a 82	82	87
Illinois Power & Light 7 per cent	a 92	84	95
Kansas Gas & Electric 7 per cent	a 94	92	97
Long Island Lighting 7 per cent	98½	95½	102
Minnesota Power & Light 6 per cent	89	78	90
Mississippi River Power 6 per cent	a 88	80	90
Nebraska Power 7 per cent	96	89	99
Niagara Falls Power—25	a 28	27	29
Niagara, Lockport & Ont. Power 7 per cent	a104	99	107
Northern States Power 7 per cent	a 96	91	97
Ohio Public Service 7 per cent	a 93	86	100
Pacific Gas & Electric 6 per cent	a 94	85	94
Penn-Ohio Power & Light 7 per cent	92	84	96½
Pennsylvania Power & Light $7—no par	99½	93	99½
Penn. Public Service 7 per cent	a 90	90	100
‡Philadelphia Electric 8 per cent—25	a 37½	29¼	39¾
Southern California Edison 8 per cent	a115	112	120
Tennessee Electric Power, 6 per cent	a 71	47	71
Texas Power & Light 7 per cent	97	95	97½
Utah Power & Light 7 per cent	95	94	96½
Western States Gas & Electric 7 per cent	a 84	78	86
Yadkin River Power, 7 per cent	97	94	99
Holding Companies			
American Gas & Electric 6 per cent—50	a 45¾	41¼	46
American Light & Traction	a 93½	91	94½
American Power & Light 6 per cent	a 88	84	91
American Public Service 7 per cent	a 88	84	95
American Public Utilities 7 per cent	a 88	73	88
American Water Works & Electric 7 per cent	a 100¼	89¼	101
Associated Gas & Electric 7 per cent—1 per cent extra—50	a 49	42	52
Carolina Power & Light 7 per cent	a101	95½	101
Central Indiana Power 7 per cent	a 88	80	93
Cities Service 6 per cent	a 80¾	67	83
Commonwealth Power 6 per cent	a 82¼	72	82½
Consolidated Gas 6 per cent—50	a 58	51	59¾
Continental Gas & Electric 7 per cent pr. pf.	a 90	69	93
Electric Bond & Share 6 per cent	a102	96½	104
General Gas & Electric—$8—no par	a105	96	105
*Middle West Utilities 7 per cent	a 93	80	93
National Power & Light—$7—no par	a 93	84	96½
North American 6 per cent—50	a 47½	43¼	50½
Northern Ohio Electric	a 25	16	34
Public Service Corp. of N. J. 7 per cent	a 99	96½	101¼
Public Service Corp. of N. J. 8 per cent	a110½	99½	115
Standard Gas & Electric 8 per cent—50	a 50	46½	50
†United Gas Improvement—50	a 58	55¼	58
United Light & Power—$6.50—no par	83	75¼	84
•COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	a 32	22½	34
Appalachian Power—no par	a 77	66	93
Arkansas Light & Power	a 60	22	63
Brooklyn Edison	a123	107½	124½
Buffalo General Electric	a190	118	190
Colorado Power	a 33	21	35
*Commonwealth Edison	a135½	126	136½
§Consolidated Gas, Electric Light & Power	a 33¼	32½	37½
Dayton Power & Light	a170	70	180
Detroit Edison	a115	102½	115½
|| Edison Electric Illuminating of Boston	a195½	163½	197
Long Island Lighting	200	100	200
Mississippi River Power	a 33	18	35
Montana Power	a 74½	61½	74½
Niagara Falls Power—no par	a 42	42	47
Niagara, Lockport & Ontario Power—no par	a 53	42	53
Northern Ohio Electric—no par	a 8	5	16
Northern States Power	a103	92	106
North Texas Electric	a 70	58	84
Pacific Gas & Electric	a103½	90½	104½
‡Penn Central Light & Power—no par	60	57	60
§Pennsylvania Water & Power	a129	98½	135¼
‡Philadelphia Electric—25	a 38¾	29	39¾
*Public Service Co. of Northern Illinois	a110	96	110
Puget Sound Power & Light	a 59	43½	61½
Southern California Edison	a101½	95	106
Tampa Electric	a170	134	170
Tennessee Electric Power—no par	a 49	20	49
Virginia Power	a 70	16	70
Virginia Railway & Power	a 68	36	72¼
West Penn. Co.	a118	47½	121
Holding Companies			
‡American Electric Power—50	a 1	22½	62½
American Gas & Electric—no par	a 79½	43½	115
American Light & Traction	a138	115	148
American Power & Light	a 58	34½	58
American Public Utilities	a 75	35	97
American Water Works & Electric	a 39½	24	39¾
Carolina Power & Light—no par	a330	82½	330
Cities Service	a170½	140	187
Columbia Gas & Electric—no par	a 45¾	33	46¾
Commonwealth Power Corp.—no par	a122½	56	122½
Consolidated Gas—no par	a 78½	60¾	79¾
Continental Gas & Electric	a 84	49	96
Federal Light and Traction	a122½	75	122½
General Gas & Electric	a 61	22	63
Lehigh Power Securities—no par	a 89½	31	89½
*Middle West Utilities—no par	a 77½	41	86
National Power & Light—no par	a189	60	190
Philadelphia Co.—50	a 54¾	42½	55½
Power Securities—no par	a 16	4	18
Public Service Corp. of N. J.—no par	a 68½	39	69½
Standard Gas & Electric—no par	a 41	31½	41¾
United Gas & Electric (Conn.)—no par	a 32	14	42
Utah Securities	a 46	16½	46
BONDS			
Operating Companies			
Adirondack Power & Light 6s 1950	a102½	97½	103
Alabama Power 5s 1946	a 95½	90½	97
Appalachian Power 5s 1941	a 95½	89	96
Brooklyn Edison 5s 1949	a 99½	97½	102½
6s 1930	103½	102½	106½
7s 1940	107½	107	110½
Cleveland Electric Illuminating 5s 1939	a 99½	98½	101
Commonwealth Edison 5s 1943	a 99½	95	101
5s 1953	a 98½	92	99½
§Consol. Gas, Elec. Lt. & Pwr. 4½s 1935	92½	91	96
6s 1949	a105½	102½	106
Consumers' Power 5s 1936	a 98½	94½	99½
5s 1952	90½	87	92½
Detroit Edison 5s 1933	a101	99	101½
Duquesne Light 6s 1949	a105½	103½	106½
Great Western Power 5s 1946	95	90½	96
Kansas City Power & Light 5s 1952	a 96½	89	96½
Mississippi River Power 5s 1951	a 97½	92	97½
Montana Power 5s 1943	a 97½	95	99
New England Power 5s 1951	a100½	97	101½
New York Edison 6½s 1941	a113½	109½	114½
Niagara Falls Power 6s 1950	a105½	104	106
Northern States Power 5s 1941	a 93½	89½	94½
6s 1941	a104½	101	105
Ohio Power 7s 1951	a106	103	107
Pacific Gas & Electric 5s 1942	a 94½	90½	95
Pennsylvania Water & Power 5s 1940	a 99½	96	100
‡Philadelphia Electric 5s 1966	a100½	97	103½
5½s 1947	a103½	99½	105
6s 1941	a106½	103½	107½
Portland Electric Power 6s 1947	a 94	89½	97
Southern California Edison 5s 1939	a 99	96	100
6s 1944	a102½	100	103½
Tennessee Electric Power 6s 1947	a 99½	93½	99½
Texas Power & Light 5s 1937	96½	91½	97
Toledo Edison 7s 1941	a109½	106	110
Utah Power & Light 5s 1944	a 91½	87½	93½
Holding Companies			
Alabama Traction, Light & Power 5s 1962	a 83½	65½	86
American Gas & Electric 6s 2014	a 94½	94	95½
American Power & Light 6s 2016	a 93½	91	94½
Amer. Water Works & Electric 5s 1934	a 92	84½	94
Associated Gas & Electric 6½s 1954	94	92½	94½
Central Indiana Power 6s 1947	a 95½	88	96½
Commonwealth Power 6s 1947	a 97½	87	98
Consolidated Cities Lt., Pwr. & Tr. 5s 1962	a 75½	64	76½
Illinois Power & Light 6s 1953	a101	95	101
United Light & Railways 5s 1932	94	87½	94½
6s 1952	96	92	97½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	a104	90	104
*National Carbon	122	112	125
Worthington Pump & Machinery—A	a 89½	68	89½
COMMON STOCKS			
Allis-Chalmers Manufacturing	a 72¾	41½	72¾
American Bosch Magneto—no par	a 34½	22½	38½
Electric Storage Battery—no par	a 65½	50½	66
General Electric	a284½	193½	284½
General Electric—10	a 11½	10½	11½
*Hurley Machine—no par	a 61	48	66
†Wagner Electric	27	20	34½
Westinghouse Electric & Manufacturing—50	a 69½	55½	70½
Worthington Pump & Machinery	a 72¼	23½	72½
BONDS			
Canadian General Electric 6s 1942	a107½	102½	107½
General Electric 3½s 1942	84¼	80	84½
5s 1952	a105	100	105½
Robbins & Myers 7s 1952	66	66	91½
†Wagner Electric Manufacturing 7s	101	97	101½
Western Electric 5s 1944	a 98½	96	99½
Westinghouse Electric & Mfg. 7s 1931	a108	106½	109½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange. § Baltimore Stock Exchange
a Bid price Wednesday, December 17.

common dividends, its credit is so good with investors that recently it was able to sell first and refunding mortgage bonds on a 5.50 per cent yield basis. The reasons are not hard to find on an analysis of the values that lie back of the bonds. Net earnings available for interest during the twelve months ended October 31, 1924, were approximately twice the requirements on all mortgage bonds presently to be outstanding. The original cost of the properties is over 150 per cent of the principal amount of all mortgage bonds outstanding, taking the valuation used by the Public Service Commission on December 31, 1920, plus net additions since that time. Based on present prices, of course, the replacement value would be much larger.

Dividends Declared

The following quarterly dividends were announced by central-station companies and electrical manufacturing companies during the past week:

Name of Company	Per Cent	When Payable
Asheville Power & Light, pf	$1.75	Jan. 2
Carolina Power & Light, pf	$1.75	Jan. 2
Carolina Power & Light, com	$1.50	Feb. 2
Coast Valley Gas & Elec., 6%, A pf.	1½	Jan. 1
Coast Valley Gas & Elec., 7%, B pf	1¾	Jan. 1
Columbus Elec. & Pwr., 1st pf., A	1¾	Jan. 2
Columbus Elec. & Pwr., 2d pf	1¾	Jan. 2
Columbus Electric & Power, com	2½	Jan. 2
Consumers Elec. Lt. & Pwr., pf	1¾	Dec. 31
Continental Gas & Elec., ex., pfc. pf*	½	Jan. 1
Continental Gas & Elec., ex., pfc. pf	25c.	Jan. 1
Continental Gas & Electric, pf	$1.50	Jan. 1
Continental Gas & Electric, pfc., pf.	$1.50	Jan. 1
Continental Gas & Elec., pr. pref.	$1.75	Jan. 1
Dayton Power & Light, pf	1½	Jan. 2
Dayton Power & Light, com	1	Jan. 2
Detroit Edison	2	Jan. 15
Kentucky Securities, pf	1½	Jan. 15
Kentucky Securities, com	1½	Jan. 2
Metropolitan Edison, pf	1¾	Jan. 2
Narragansett Electric Lighting	$1	Jan. 2
Nevada-California Electric, pf	1¾	Feb. 2
Northern Ohio Trac. & Lt., 6% pf.	1½	Jan. 2
Northern Ohio Trac. & Lt., 7% pf.	1¾	Jan. 2
Northern States Pwr. of Delaware, pf.	1¾	Jan. 30
Northern States Pwr. of Del., com.	2	Feb. 2
Ottawa Light, Heat & Power, com.	1¼	Dec. 31
Ottawa Light, Heat & Power, pf	1¾	Jan. 2
Pennsylvania Edison, pf	$2	Jan. 2
Pennsylvania Power & Light, pf	$1.75	Jan. 1
Portland Elec. Power, 1st and pr., pf.	1¾	Jan. 2
Standard Gas & Elec., 7% pr. pf	1¾	Jan. 26
Standard Gas & Electric, com	75c	Jan. 26
United Gas Improvement, com	2	Jan. 15
United Light & Railways, 1st pf	1¾	Jan. 2
United Light & Railways, pfc., pf	2	Jan. 2
United Light & Railways, com	2	Feb. 2
Yadkin River Power, pf	$1.75	Jan. 2
Century Electric, com	1½	Dec. 22
Century Electric, pf	1¾	Jan. 1
Electric Storage Battery, ex., com	$1	Jan. 2
Electric Storage Battery, reg., com	$1	Jan. 2
Western Electric, com	$2.50	Dec. 31
Western Electric, pf	$1.75	Dec. 31

* In common stock.

Company Reports

Among the company reports issued during the past week for the month of October are the following:

Name of Company	Gross Revenues for October 1924	1923
Arkansas Light & Power	$152,393	$132,765
Detroit Edison*	2,810,324	2,606,317
Federal Light & Traction	468,490	455,516
Havana Elec. Ry., Light & Pwr.	1,197,400	1,130,044
Manila Electric*	332,602	305,023
Milwaukee Elec. Ry. & Light	1,858,506	1,850,167
Mississippi Power & Light	133,361	107,882
New Bedford Gas & Edison Lt.	314,595	293,201
North American Co. and sub.	6,820,103	6,466,866
Utah Securities*	951,245	910,558

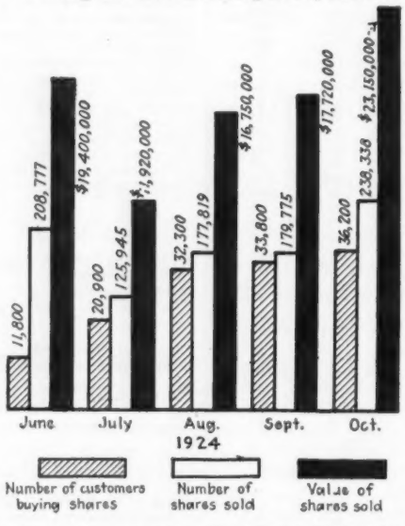
* November.

Manufacturing Company Increases Capital Stock.—The Marion Electric Corporation at Marion, Ind., has increased its capital stock from $25,000 to $100,000.

October Customer Stock Sales Total $23,150,000

Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power companies selling stock direct to customers or employees, it is estimated that during October a total of 238,338 shares was sold in this manner. The total value of this stock is estimated at $23,150,000, and 36,200 customers or employees bought the stock. The average sale to each such purchaser amounted to $639.

During the five-month period, June to October, for which data are available a total of 930,654 shares has been sold under the customer-ownership plan. The value of this stock is estimated at $88,940,000, and it was sold to 135,000 customers or employees. The average sale to each customer was $658.



WHILE THE VALUE OF CUSTOMER SALES DURING THE SUMMER MONTHS SHOWED A DECREASE, THE NUMBER OF PURCHASERS STEADILY INCREASED

New Weston Corporation Offers Stock

The Weston Electrical Instrument Corporation, organized to succeed the Weston Electric Instrument Company of Newark, has offered through Hornblower & Weeks and Hambleton & Company 100,000 shares of class A stock at $25 per share to yield 8 per cent, each share carrying a bonus of one-quarter of a share of common stock. The Weston Electric Instrument Company, headed by Dr. Edward Weston, who founded the business in 1888, is known internationally for the excellence of its equipment. For the past thirty-five years it has been the leading manufacturer of electrical instruments in the United States, turning out apparatus of exceptional merit and of a grade unsurpassed by that of any other manufacturer in this country or abroad. The class A stock is entitled to $2 cumulative dividends from the date of issue, payable quarterly, and is callable at $37.50 a share on thirty days' notice. The stock is also preferred as to assets and dividends in liquidation up to $31 per share, in addition participating equally in all cash dividends after payment of $1 a share in any year on the common stock. Earnings of the predecessor company for the year 1924 (two months estimated) equal $3.69 a share on the class A shares as compared with $2.40 in 1923. The offering was oversubscribed.

Cities Service Earnings Increase.—Gross earnings of the Cities Service Company for the twelve months ended October 31 amounted to $17,289,953 as compared with $16,592,772 in the corresponding period of 1923.

Southern California Edison to Issue Stock.—The State Railroad Commission of California has authorized the Southern California Edison Company to issue 7 per cent preferred stock, series A, to the amount of $10,000,000.

Brooklyn Edison to Redeem Bonds.—The Brooklyn Edison Company, Inc., will pay off all of its 7 per cent general mortgage gold bonds, series C, on January 1, the next interest date. The company recently redeemed its 7 per cent, series D, general mortgage bonds.

December Maturities. — Among the public utility issues paid off on December 1 were the 5 per cent bonds of the Commonwealth Power Company, amounting to $1,078,000, and 7 per cent notes of the National Light, Heat & Power Company totaling $434,000.

Canadian General Electric Stockholders Vote Stock Increase. — Shareholders of the Canadian General Electric Company have authorized the creation of 52,000 additional shares of preferred stock, par value $50. This stock, together with a similar amount of common stock now in the treasury, will be turned over to the American General Electric Company at par for the purpose of redeeming 6 per cent debentures to the amount of $5,000,000.

To Retire Debenture Bonds. — The Federal Light & Traction Company will call for redemption on March 1, 1925, the thirty-year 7 per cent debenture gold bonds, series A, due March 1, 1953. These bonds are now outstanding to the amount of $750,000. The company has sold to a banking group an issue of $2,500,000 new convertible 6 per cent debentures, which will soon be offered for public sale, the proceeds to be used for additions and improvements and partly to retire the 7 per cent debentures.

Wisconsin Gas & Electric Receives Authorization.—The Wisconsin Gas & Electric Company, which supplies electric light and power, gas, street and interurban service in Racine, Kenosha and the surrounding communities, has been authorized by the Railroad Commission of Wisconsin to issue $1,000,000 in first mortgage 5 per cent bonds. The gross earnings of the company for the twelve months ended September 30, were $4,511,000 and the net income $1,178,530, which amount is four times larger than the annual interest charges on its mortgage bonds, including the new issue.